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COMPUTER ASSISTED TUTORIAL AS A SUPPLEMENTARY LEARNING TOOL

BY

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SYLVIA CAFORIO

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FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommended to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled COMPUTER ASSISTED INSTRUCTION AS A SUPPLEMENTARY LEARNING TOOL IN SECONDARY EDUCATION submitted by SYLVIA CAFORIO in partial fulfilment of the requirements for the degree of Master of Education in Vocational Education.

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ABSTRACT

This exploratory research study involved the design, development, validation and implementation of a computer assisted instruction (CAI) tutorial for beauty culture students enrolled in a vocational beauty culture program. In this study the CAI tutorial was used as a supplement to teacher delivered instruction. The primary focus of this research was to determine if CAI, used as a supplement to teacher delivered instruction, would improve students achievement scores.

The sample for this research study consisted of 47 grade 11 high school students enrolled in a vocational beauty culture program. The study was based on a pretest/posttest design. Students were assigned into CAI treatment and control groups. Both the CAI and control groups received classroom instruction. The treatment of the control group, following the teacher classroom presentation, consisted of completing worksheets using the textbook as a resource. Students in the CAI treatment group received the CAI tutorial as a treatment to reinforce the teacher classroom presentation.

The results of the study suggested that the students in the CAI treatment group generally achieved higher posttest achievement test scores than the control group, not exposed to the CAI treatment. Although no statistical tests were conducted because this research was an exploratory study. An observation of the findings also indicated that students demonstrated higher concentration levels, students were less distracted, when using the CAI tutorial to review and study the lesson material.

The conclusion reached in this study suggest, that CAI used as a supplement to teacher delivered instruction may have potential benefits for vocational beauty culture education students and should be tested experimentally. The researcher recommends that more research is needed over a longer period of time using larger samples to determine the effect CAI has on student cognitive achievement when used in this way.

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CHAPTER I

THE RESEARCH PROBLEM

Introduction

The educational system of the 90's is being challenged to provide students with a learning environment that is effective as well as efficient. Fulfilling the educational needs of every student can indeed become a formidable task for the teacher when diverse individual differences of students exist within a classroom. These differences might include; ability of learner; educational maturity of the learner, preference for learning style, and attention span of the learner. These differences present a challenge for the teacher as well as the student in a traditional educational setting where the teaching style is teacher-dominant. Some students in this type of a learning environment are easily distracted and/or may have difficulty absorbing the material presented.

Students enrolled in the beauty culture program that is offered at the high school level often include special needs students who may require individualization of instruction to accommodate different learning styles and other individual differences. Computer Assisted Instruction (CAI) represents an alternate delivery strategy for the individualization of instruction.

For the past three decades CAI has been utilized to aid teachers to deliver instructional content to learners. Towel (1978) defines CAI as a method that "directly assists in the teaching and/or presentation of learning materials" (p. 2). Godfrey and Sterling (1982) stress that CAI presents a means of using the computer to present instructional material in the form of a tutorial. Educators who have been trained in the use of CAI are in a position to produce, monitor, test and update programs used for instruction to aid both the learner and the teacher

CAI can be used to enhance and to supplement traditional teaching methods. For instance, high school students who are absent from class or find "the pace of teaching, which may be aimed at the middle, is too fast for many and too slow for others" (Minstrell, 1988, p. 266) can take advantage of CAI. Students would

be assured access to CAI material to be learned at a later date or time.

The instructional content for a high school beauty culture program includes two major interrelated components, theory and practice. It is important for the student to acquire theoretic knowledge and to develop the ability to transfer that knowledge to solve practical problems in the beauty culture laboratory. Pea (1988) takes the position that knowledge transfer is most commonly described as one-directional and therefore incomplete and questions how educational knowledge, acquired in the schools, can be transferred to everyday life and work situations. Therefore using CAI as a learning tool may help beauty culture students in the preparation for transfer the theoretical knowledge to practical situations.

CAI can assist individual beauty culture student who may have differences in ability, attention span and preference for different learning style to acquire knowledge and to transfer that knowledge to a practical problem solving situation in the beauty culture laboratory. As early as 1958, Ferster and Sapon recognized that CAI could reduce the difference in achievement of students with

dissimilar ability levels by utilizing programmed instruction on the computer. Most teachers during that era would not have dreamed of using the computer as an instructional device in the classroom. The use of computer technology to provide the individual student with the opportunity to use self-paced instruction will provide the student with some degree of control over his or her learning. CAI can assist the student to acquire the required theoretical concepts which may help the student to solve practical problems at the job site. Sizemore and Pontious (1987) found that a "Combination of tutorial, questions, simulations and required application of material learned to a practical situation assisted students in learning as well as transfer this learning into practical situations." (p. 66).

Problem Statement

Advancement in computer technology development, and the effect it has on the educational system continually transforms the way instructional material is delivered to the learner in an educational setting. Many schools are equipped with both computer hardware and software to assist in the delivery of educational

material to provide the student every opportunity to achieve mastery learning.

In this era of information technology, the role of the student and the teacher is changing. Vast amounts of information and knowledge are available to assist the student in everyday life, so much that it is impossible to learn all that is available. Students will have to learn how to obtain information that is needed at different points in their lives and how to access and use the huge amounts of resources that are available (Lockard, Abrams & Many, 1987).

Supporters of computer use in instruction need to find ways and methods to assist students to learn how to use this technology as an ongoing learning process. Educators have to provide means to use technology effectively and efficiently to deliver instruction to the learner. This can be accomplished through the use of Computer Assisted Instruction (CAI) or Computer Managed Learning (CML).

To explore this approach to teaching and learning, this study uses CAI to help improve student achievement when used as a supplement to teacher delivered classroom instruction, was the problem of this research.

Need for Study

The trades and services sector of the Canadian labor force advocates quality education in order to be successful in a growing and demanding labor market that is becoming increasingly competitive. With living standards on the rise, higher demands are being placed on beauticians to provide professional services within the beauty culture industry. The ever increasing demand placed on highly skilled service sector personnel will provide more employment opportunities for personnel who are highly qualified.

Canadian business relies on apprenticeship and on-the-job training as well as the education system to provide young people with the skills required to enter the world of work with its many challenges. Students need to be stimulated and motivated to optimize their learning potential while in high school. Teachers need to provide a stimulating learning environment that will benefit each student and give purpose to the student to study and learn. If vocational education is to contribute to the preparation of people for industry it is necessary for teachers of this area to develop instructional material that will encourage students to develop

positive attitudes towards learning which will lead to the development of attitudes, aptitudes and work skills. One method of organizing instructional content and presenting that content to the learner is CAI.

A teacher using CAI to present the theoretical content to the learner may provide the necessary learning environment that will accommodate students' individual differences. CAI has the potential to individualize instruction that will allow each student to learn at a speed and in a mode most suited to the unique learning style of the learner (Kearsley, 1983). At the time of this study, a CAI program on anatomy for beauticians was not available on the educational market. This helped to establish a need for the study.

Considerable research has been completed to determine the effects CAI has had on student achievement in a variety of educational settings and in different subject areas. A review of the literature and data bases show no studies were reported that investigated the effect CAI had on high school student achievement in a beauty culture program. It is evident from the professional literature that CAI for the theoretical portion of the beauty culture curriculum is non-existent. This void helped to establish a need for

the study to examine the effects CAI had on vocational education students in secondary education.

Delimitations

The study had the following delimitations:

1. To the lessons in anatomy topics of Osteology and Myology using Unit 33 from The Professional Cosmetologist 3rd Ed, a text recommended by the Curriculum Branch of Alberta Education.
2. To four groups of high school students enrolled in the Beauty Culture 22/32 Program offered in the three participating high schools.
3. To information received from Beauty Culture Teachers in participating high schools relative to the instructional content presented to the students for units in Osteology and Myology using a traditional delivery strategy.
4. To the amount of time, two 80 minute periods, and how often students used the CAI as a tutorial method of instruction.

Definitions

Various definitions are given throughout this thesis, however some predominant terms used in the study are given below:

Computer Assisted Instruction (CAI) In this study the terms CAI, Computer Assisted Learning (CAL), Computer Based Instruction (CBI) and Computer Managed Instruction (CMI) are used interchangeably.

Leading authorities in CAI (Hooper,1975., Sheingold, K., Kane, J.H., & Endreweit, M.E. 1983., Bangert-Downs &Kulik,1985) seem to agree with Godfrey and Sterling's (1982) definition for the term Computer Assisted Instruction which represents a teaching method using a computer to deliver tutorial instruction to a student which stresses lesson objectives and careful measurements of the achievements. Bangert-Downs and Kulik (1985) consider CAI from the perspective either of its use to provide drill and practice exercises to a learner with no new teaching material presented or tutorials which would include the presentation of new concepts and material to be learned. CAI is an instructional strategy that teachers may use to individualize instruction for learners who have

different needs. Learning modules presented by CAI to a learner are basically designed for the individualization of instruction and are most efficient when the instructional module is used with one computer per student (Lockard, Abrams, & Many, 1987). Cromer and Steinberger, (1989) consider CAI a generic term which includes both the software and the hardware that is used to promote learning. The definition for CAI that Chambers and Sprecher (1983) provide concentrates on CAI "as the use of a computer to provide course content instruction in the form of drill and practice, tutorials, and simulations." (p. 3). Although there is disagreement as to how CAI is defined, these authorities would agree that this method of delivering instructional content has its advantages and disadvantages.

For the purpose of this study CAI, a computer program specifically developed for this study, is defined as an instructional strategy to help vocational education students enrolled in a high school beauty culture program attain higher levels of achievement.

Self-Paced Each student will advance in the CAI tutorial at his or her own speed. According to Gagne, Briggs and Wager "Self-paced instruction is a phrase implying instructional management by the

learner as well as the mediation of instruction. ... the learner can spend as much time as necessary to achieve the objectives" (p. 225). Self-paced instruction is often linked to the process of mastery learning in which attainment of objectives rather than time directs the learner's progress through the instructional material. In this study the student will be given a certain time frame in which to complete the CAI lesson but the opportunity is provided to allow the student to use the CAI on his or her own time.

ORGANIZATION OF THESIS

The thesis has the following organizational pattern:

Chapter II presents a review of some of the relevant literature to provide a conceptual framework for the study as well as research that is related to the study. Chapter III provides a description of the research design and the methodology that was employed to collect data and the analysis on the collected data. Chapter IV interprets the data as it relates to the research problem. Chapter V provides a summary of the study conclusions, observation and suggestion for further research.

CHAPTER II

REVIEW OF RELATED LITERATURE AND RESEARCH

Introduction

The purpose of this chapter is to review findings of relevant literature and research relevant to the present study. In the past three decades much has been accomplished in the area of Computer Assisted Instruction (CAI), Computer Based Instruction (CBI) and Computer Aided Learning (CAL). The main frame computer has been used as a vehicle to deliver instructional material to students since the early 1960's. Within thirty years the computer evolved from the mainframe to the microcomputer which has led to increased research related to CAI. Research, development and implementation of instructional material via CAI is still in its infancy. Yet to be investigated is the full potential of CAI for instructional purposes. This chapter consists of seven interrelated sections: overview of the historical development of computers in education; advantages and disadvantages of CAI; student cognitive achievement; individualized instruction; students with special

needs; learner control; courseware design and instructional strategies, and conclusion.

An Overview of the Historical Development of the Computer in Education

Numerous experiments have been conducted at the post secondary level of education which evaluated and tested the effectiveness of CAI. Using the computer for drill and practice in a tutor mode first emerged in the early 1960's from the work of B.F. Skinner a behavioral psychologist at Harvard University who was responsible for linear programmed instruction.

Homme and Glaser (1960) in their work with computers to provide instruction found students who used the computer to be more successful than those who received only conventional classroom instruction. Making use of the computer for instructional purposes helped to motivate many educators to work towards integrating this expanding and dynamic technology into all aspects of education.

It was recorded that the computer laboratory, at Dartmouth College, New Hampshire, was used for instruction in certain

academic disciplines as early as 1964 (Report of the Director, 1975). Hooper (1975) indicated that "the computer promised the kind of flexibility to individual learner response which could not be matched by either programmed texts or non-computerised teaching machines" (p. 14).

During the late 1960's, IBM installed thirty-four, System 1500 computers in educational institutions, on a worldwide basis. This system was specifically designed for authoring and delivering CAI. The authoring language Coursewriter II was an assembly type of language and was difficult for the average user to program. One such system was installed at the University of Alberta, in 1968, and made available to the staff of the Division of Educational Research Services in the Faculty of Education (Szabo & Montgomerie, 1990).

Petruk (1975, 1977,1978) of the University of Alberta used the System 1500 for a series of projects that were funded jointly by *Alberta Advanced Education and Manpower and Canada Manpower and Immigration.* The result of these projects was a program for electrical theory which was a method used to instruct first year electrical apprentices who were attending Northern Alberta

Institute of Technology (NAIT) for the technical training phase of their program.

The early use of computers in the 1960's and 1970's for instruction purposes involved large mainframe systems and was primarily aimed at the post secondary learners. During this period, although the mainframe computer was used as a means of delivering instructional content for post secondary education, it had a ripple effect on secondary education (Hooper, 1975). This phenomenon continued until the emergence of the microcomputer in the late 1970's when school boards were able to acquire computer equipment at a reasonable cost. With the advent of the microcomputer, research was conducted into the merits of using computer technology as a teaching strategy at all grade levels. In the 1960's, it was predicted that the abilities of computer simulation and graphics would become an important medium in the delivery of instructional materials (Machover, 1969; McKenzie, 1978). As the thrust for more computing power continued, CAI began to receive political and financial support from government agencies. This support provided the connection which linked the "continuing

demands on education to respond imaginatively to the country's industrial/vocational requirements" (Hooper, 1978, p. 6).

In the mid 1970's, Control Data Corporation (CDC) at a New York press conference announced the commercial availability of Programmed Learning and Teaching System (PLATO). An important feature of this system was the plasma display screen which was invented at the University of Illinois. This screen in addition to providing animated graphics also provided touch screen panels and a host of other features, some of which were under development at the time of the announcement (Pantages, 1976).

The PLATO system was installed at the University of Alberta in 1980 and during its active operation, researchers, educators, and students made extensive use of PLATO for instructional purposes. This resulted in numerous studies, in such areas as medicine and nursing education, engineering, and educational statistics. One of the more significant of these studies was the one conducted by Boblin and Gibson (1985/86) who used PLATO to deliver a CMI unit to teach anatomy and physiology to university nursing students. PLATO as a system was distinguished by the amount of its computing capacity, its greatly improved authoring capability and

the large number of terminals that could be supported by the system. Teachers used the system to develop and implement courseware and students employed the system in the modes of CMI and CAI (Hallworth & Brebner, 1980).

Computing power has become less expensive and more readily available to educators and students as well as to the general public. As a result there has been an increase in the amount of research of computers in instruction, and the effectiveness and potential use of this technology in education (Kennedy, Armstrong, 1980.; Roblyer, 1985.; Moore, 1985.; Bangert-Downs, Kulik &Kulik, 1985.; Boblin & Gibson, 1986.; Miklos, 1986.; Ronald, & Skiba, 1988.; Mancey, 1989.; Rumbold, 1989.; Barnes, 1990).

A meta-analysis study by Bangert-Drowns, Kulik and Kulik (1985) of 42 evaluations of computer-based education showed that it resulted in positive effects on achievement with junior high school and senior high school students. This supported an earlier meta-analysis of 59 independent evaluations which reported small but significant improvement in academic achievement which resulted from computer-based instruction. (Kulik,Kulik, & Cohen, 1980)

The past 30 years have shown dedicated researchers and educators spending time, money and effort investigating the potential of instructional computer technology. The *knowledge explosion* which has occurred during these years has begun to change society and the resulting forces have begun to demand education at all levels to clarify and redefine its purpose and procedures.

Advantages and Disadvantages

> Despite the problems of introducing computer technology to education to date, we have gained enough experience and promising results to recognize that with the new technological tools, educators and students alike can accomplish more than heretofore possible and move learning forward to new levels of excellence. (Cromer, Janis & Steinberger, 1989, p. 9)

As the procedures, rules and processes of computers in instruction emerged from analysis of past research some researchers had conflicting opinions as to the validity and merit of CAI or CAL in an educational environment. McKenzie (1978) was not favorably inclined towards the instructional capabilities of the computer as a teaching tool. McKenzie did not agree with Hooper (1978), who made positive predictions about the educational value of

CAI and CAL, but saw the direction of instructional use of CAI and CAL go towards low level skill acquisition which could be provided by drill and practice CAI programs. McKenzie disputed Hooper's claim that the "computer can be a teaching machine, able to respond with individual guidance to a student with difficulty." (McKenzie, 1978, p. 25). McKenzie maintained that the computer has limited communication ability and therefore cannot compete with a human teacher for interaction and guidance. On the other hand he stated that "Interactive computer graphics is one form of computer-assisted learning, and as such its aim is to encourage an enrichment of learning, which can be attained in no other way" (McKenzie, !978, p. 47). McKenzie contends that interactive computer graphics to support CAL can be an important aspect at higher cognitive levels of learning. Hooper, on the other hand recognized and predicted the importance of CAI and CAL in the delivery of curriculum across all levels of education.

In the late 1970's and early 1980's the microcomputer made its appearance and because of its relatively low cost became readily available to schools which made use of this technology in classrooms at all levels of education. With this in mind it is

possible that "In the future, classroom teachers could become instruction managers, focus on students conceptual skills and social development" (Sheingold, Kane, & Endreweit, 1983, p. 418). Sheingold makes reference to a three tiered system of instruction: "master teachers, supervisors of computer instruction, and aides of computer instruction" (Sheingold et al., 1983, p.418). The study further concluded that the effects of microcomputers on education will depend "on the social and educational context within which they are embedded" (Sheingold et al., 1983, p. 413)

Despite the controversies over the years, the computer has an important role in the instructional environment. According to Bell (1985) computer assisted learning should be used whenever possible within a structural framework of a learning system. This segment of the literature review has recapitulated some of the elements in the continuing deliberation of the effectiveness of CAI as an instructional strategy for delivering curriculum. Although not all researchers concur with those who support CAI, the commitment of the individual to use CAI, especially recently created models, should be reviewed with consideration of the target population, and be tested and validated.

CAI and Achievement

The outcome of numerous studies (Homme & Glaser, 1960; Brown, 1969; Boblin & Gibson, 1986) concur that research results do confirm that achievement did improve because of the use of CAI. One of the earliest studies that was conducted was that of Homme and Glaser (1960) who found that students using computer instruction had higher achievement test scores than students who received only conventional classroom instruction. The computer was used to present information in a mode which addressed the needs of the student (Homme & Glaser, 1960).

Hallworth and Brebner presented a report to Alberta Education on the influence CAI has on scholastic achievement and advocated that:

> "When CAI has been introduced as a supplement to other methods of instruction, achievement levels have frequently increased substantially. Students have expressed positive attitudes to this new means of learning and there is evidence that attention span has increased." (p. 6)

Davidson, (1985) examined the effectiveness of a mathematics course delivered through CAI and measured mathematics

achievement scores of students receiving traditional lecture type classroom instruction and compared their test scores with student achievement test scores using computer assisted instruction. Although the result of Davidson's study indicated that CAI did result in some gains of mathematical achievement these gains were not deemed very significant. Davidson suggested that the use of CAI would be a valuable tool in facilitating the learning process of students.

Edwards (1975) and Glass (1982) found that the supplementary use of CAI as a study guide in the classroom to be more effective versus replacing the CAI with classroom instruction. Kulik (1983) on the other hand found that the factor of *supplementary versus replacement* made no significant difference in achievement scores. (Roblyer, 1985)

Dyamett's (1986) study was to determine if computer assisted instruction (CAI) used in a basic accounting course had an effect on student achievement when compared with traditional methods of delivering course content. In this study both the CAI treatment and control group used the same textbook, covering the same instructional material. The CAI treatment group received traditional

instruction supplemented by CAI. The control group did not use the computer to reinforce or supplement classroom instruction. The results of Dyamett's study indicated that the scores of the CAI treatment group when compared to the control group, the one not using CAI, did not differ significantly (1986). An important outcome of this study was that CAI proved to be equally effective but not necessarily better then conventional instruction. The use of computers to deliver instruction may increase achievement but other elements such as inherent aptitude of the learner may also influence achievement. The most important factor supporting this concept is the flexibility of the interaction between computer and student (Brown, 1969).

The study of Boblin and Gibson (1986), conducted at the University of Alberta Hospital School of Nursing, indicated the use of computers in instruction bolstered student success rate in learning the components of the Anatomy and Physiology course. The findings of the researchers indicate that the components of the computer course were an excellent supplement to the existing instruction techniques that were used by instructors. When the results of the study were compared with previous student records

there was a decrease in the number of students who had difficulties with the course content as well as the diminished attrition rate among students in the course.

Another conclusion of the Boblin and Gibson (1986) study was that students reported *increased comfort levels* working on the computer system at hours that were convenient for them. The result of the Boblin and Gibson's (1986) research shows that effective instructional software will facilitate the effective use of computers in the classroom.

Sizemore and Pontious (1987), using CAI modules to determine the effectiveness of teaching aspects of health assessment to 68 junior baccalaureate nursing students, support that "Students using CAI modules, scored significantly better than classroom students" (p. 66). The outcome of Sizemore's study is consistent with the results reported by Bitzer and Bordreau (1969), Conklin (1983) and Boblin & Gibson, (1986).

The results of the studies by Bitzer and Bordreau (1969), Conklin (1983), and Boblin and Gibson (1986), contradict findings of previous research which concluded that students using CAI attained the same level of achievement as those students who learned when

traditional modes of instruction were used. These studies documented there was little or no significant differences in achievement scores between the two groups and found that learning was accomplished as effectively when traditional classroom mode of instruction was involved (Larson, 1983; Kulik, 1983; Day & Payne, 1984; Davidson, 1985; Moore, 1985; Dyamett, 1986). Conversely, the results from past and current studies show that students using CAI achieved higher test scores than students taught only with traditional classroom instruction (Homme & Glaser, 1960; Hallworth & Brebner, 1980; Borthick, 1986; Boblin & Gibson, 1986; Sizemore & Pontious, 1987; Wright, 1987; Juchau, 1988; Knight, 1988).

According to Winer and Mothe (1987) instruction delivered through CAI tends to produce more homogeneity in achievement test scores because students using this method of instruction have the option of repeating any part of the lesson as often as is necessary until they feel they are satisfied with their performance. Winer and Mothe further documented that achievement is enhanced by the ability of the monitor screen to display text and graphics and in many instances incorporating sound capabilities. The audio ability

of the computer can clarify pronunciations and enhance graphics or text displays with special effects. (1987) All of these abilities incorporated in a CAI presentation provides the student with an optimum learning environment increasing achievement test scores.

Wright's (1987) research explored the effectiveness of computers in instruction. This research focused primarily on the upper elementary grade levels. The procedure used by Wright to obtain data was to conduct semi-structured interviews with teachers from one urban and two rural school systems in Central Alberta. Wright found that the most current use of the computer was for drill and practice for the learner to develop concepts and problem solving skills. The findings of this research revealed extensive use was made by teachers of math drills, word processing and application software such as graphics programs. When interviewees were asked if computer use in instruction produced substantial gains in the cognitive, affective and psychomotor learning domains in both math and language instruction they answered in the affirmative. Teachers indicated that achievement test scores had increased although no formal research had been conducted to substantiate this claim (Wright, 1987).

Gray's (1987) study examined the effects of two aspects of sequence selection menus that were available to students who had control over their own progression of instruction in a CAI program. Eighty undergraduate college students were involved in this research. Software used was interactive in nature and required the student to make decisions concerning the concept of poverty and inflation which resulted in feedback on the effects of the students decision. Each student spent 40 minutes on the CAI lesson. The computer maintained records of student progress and at the conclusion of the lesson a multiple choice test was given and attitudes towards the CAI lesson were measured through a questionnaire. A posttest was administered a week after instruction to measure retention. The outcome of this study may have been influenced by the fact that students were homogeneously grouped by prerequisite course achievement rather than by the CAI lesson. The study found that students with greater control over sequencing performed better on the comprehension test.

Grabe, Petros and Thomas (1989) evaluated the impact of three studies of CAI on examination performance on college students working with the computer and their textbook in an interactive

mode. The findings indicated that CAI as a study guide benefitted students examination performance. The attempt of the study was to "help students deal with the information more effectively once it has been initially processed." (p. 111).

Mancey's study was an experimental study designed to assess the effectiveness of computer science simulations. The sample comprised 39 students using simulations under controlled conditions taught in a normal science class and were subject to the same topic tests. The control groups were given homework assignments using worksheets. The experimental group consisted of two pairs of students using the computer simulation programs as a study guide. The study found no significant statistical difference between the control and experimental groups.

All things considered, the review of the related literature shows that CAI which is well organized, planned and presented can increase student achievement (Duin, A. 1988). The conclusions drawn from past and present research may not be an accurate reflection of the effectiveness of CAI. Not all CAI programs that are teacher designed and prepared are of superior quality. Testing and validation of these programs is needed before implementation to

ensure student achievement is not the result of the Hawthorne Effect.

A. Duin (1988) advocates that:

> "Whether CAI obstructs or promotes learning is determined by the ways in which it is designed and used. CAI can become a catalyst for revitalizing the way in which students approach the process of learning, or it can simply be a new form of paper on line. Researchers and instructors need to grasp the power of design and develop instructional displays which are powerful, conceptual, linguistic, and visual tools for learning" (p. 54).

Individualized Instruction and Learning Styles

There are as many definitions for the term *individualized instruction* as there are authors who have written on the topic. Of the definitions reviewed perhaps the most appropriate and inclusive is the definition for the term *individualized instruction* given by Southworth (1971) who wrote:

> individualized instruction consists of planning and conducting with each pupil, programs of study and day-to-day lessons that are tailor made to suit his learning requirements and his characteristics as a learner (p. 248).

No matter which definition is chosen, *individualized instruction* is not only a method of instruction but the manner in which the educational climate is instituted and materials and equipment are organized. Individualized instruction is the combining of a number of interrelated elements into a rational whole which is directed at the individual learner's needs. This would insure an integrated instructional delivery system of pedagogical goals to assist the learner in achieving goals and objectives which are purposeful and motivational to the learners needs. Kotesky, Halley, Swanson and Tracy, (1978) found that:

> The intelligent use of computers does not force people in the same mould. Individualization may, in fact, be enhanced by individualized testing that allows students to proceed at their own speed; repeatable testing that allows mastery of materials; unique problem generation that encourages each student to do the required work; and the provision of program packages that allow individual research and experimentation (p. 72).

In contrast to traditional classroom instruction, CAI has as one of its major characteristics the ability to pace instruction to suit the learning style of the individual learner. In a conventional classroom, a student in the group who does not comprehend concepts

must proceed with the rest of the students in the class, ready or not. Similarly a bright student in a class who understands and grasps concepts quickly must wait for the rest of the class to catch up. This teaching/learning dilemma might be eliminated through the use of CAI. Using this terminology the fast learner can work ahead and not waste time with unnecessary repetitiveness and the slow learner can repeat lesson content for as long as it takes to master the concepts to be learned. Students can answer questions and interact with the computer in privacy. Steinberg (1984) takes the position that enrichment can be an important function of CAI to provide individualized instruction for the advanced learner.

Although computerized instruction does permit the student access to effective, individualized instruction there may be some inherent disadvantages one of which is individualization. As Kotesky et al., (1978) pointed out:

> Individualization places extreme responsibility on the student to pace himself. Without the traditional prodding of the instructor, students may procrastinate and get hopelessly behind with the attendant consequences that they receive lower grades. (p. 73)

On the other hand using the computer as an instructional device is intended to help the student better understand the material

previously learned, giving the student a better opportunity to work with the computer system for extended time periods. Steinberg (1984) advocates that "sometimes students need to practice a particular skill, but such practice involves accompanying unneeded practice in other skills. A unique role for CAI is to allow students to practice the deficient skill while removing unneeded practice from others" (p. 28).

Creating an individual educational program (IEP) for every student is the goal of most educators. Clearly with available technology, the tendency to personalize and individualize learning material will become important factors in developing courseware (Cromer & Steinberger, 1989).

Winer and de la Mothe (1987) perceived that traditional education approaches fall into two categories; the didactic model and the passive model emphasizing rote memorization and drill. The variety of learner styles and abilities the educator must deal with make the computer an ideal tool to help meet the challenge of these categories. "With one teacher and perhaps thirty children, the only way the teacher can deal with Ashby's Law of Requisite Variety is to deny the variety inherent in each individual pupil. (The Law of

Requisite Variety states that to control the behavior of a system, you must have at least as much variety available to you as in the system" (Ashby, 1958).

Using CAI to conform to the variety of the learner styles and ability would involve a control system to engage the student into an active/interactive learning mode. The computer can operate as an extension (Beer, 1974) of the teacher, thereby allowing more student diversity of learning and choices.

A study conducted by the New York Board of Education in 1988 revealed that 75% of students felt they understood computer delivered lesson material better and enjoyed more personal attention and interaction with the teacher than they would in a regular classroom (Cromer & Steinberger, 1989).

Rowland (1988) investigated the effect of CAI and its interaction with four constructs of individual differences (field orientation, locus of control, discrimination skill, and learning strategies) on two dependent variables (CAI tutorial and CAI simulation) to measure concept understanding and application. The subjects were 97 university elementary education majors enrolled in an elementary science methods course. Subjects were randomly

assigned to one of two groups: one group used the CAI tutorial and the other group used CAI simulation on the topic of home energy use. The program was developed by Rowland and provided parallel levels of graphics, interaction and decision making. The differences in the tutorial and the simulation consisted mainly in the provision of feedback to the user and type of interaction the user received.

Learning outcomes were measured using both a multiple choice test and an application test. The results showed that concept understanding measured by the achievement multiple choice test was superior for students who used the CAI tutorial as opposed to the CAI simulation mode. When concept understanding was tested using the application test, no significant differences were found between the two modes of CAI. The researcher felt that the lack of standardization of treatment made the comparison of treatments difficult.

CAI can become a catalyst for revitalizing the way in which students and teachers approach the process of learning (Duin, 1988) when using a system which allows teachers to track student progress and mastery of specific skills which are correlated to the curriculum objectives. Individualization lends itself well to skills

which need to be re-taught or reinforced. (Cromer & Steinberger, 1989). Szabo and Montgomerie (1990) recommend that "Learning is significantly more effective to the extent that instruction can be tailored to the unique needs of the learner" (p. 3).

The computer can be a superior medium to allow for such concepts as self-pacing, drill and practice, and reinforcing material that was previously acquired. These are some of the adaptations possible to tailor instructional content to the individual differences of the learner. This study was conducted to examine the effects CAI had on vocational education students in secondary education who often do not fit the *regular student* criteria.

Special Needs

Taking the concept of mastery learning and relating it to educational technology "it can be argued that the bridge between the learner and a cognitive ability which he is required to express" (Rotheray & Sewell, 1987, p. 75) can be facilitated through the use of computers in instruction. The whole process to achieve

bridging includes instructional computer technology, educational objectives and testing procedures.

"The role of educational technology is the extension of the learning environment which is available to the learner" (Rotheray & Sewell, 1987, p. 75). For students with special needs *normalization of experience* will provide for them a learning environment which allows the learner to devise, and develop their own mental mode. This requires possible adaptation of the learning conditions to a learner's existing cognitive structure and provisions of materials which he can act upon, giving students an awareness of the effect of action by some form of feedback (Rotheray and Sewell, 1987).

Rothery and Sewell (1987) are of the opinion that software developed and designed with special needs students in mind will be more effective than traditional classroom instruction. Students have more control over their own learning and are able to exercise a measure of independence with technology and learning. Rotheray and Sewell(1987) further reported that the use of *computer-mediated* environment had brought about great improvement of performance in special needs children.

Skinner (1988) documented that the occurrence of an operant is followed by presenting a reinforcing stimulus which increases the desired behavior. The computer presents a screen of text or a graphic which brings the student a step closer to the desired behavior. The response elicited from the student on the basis of what is learned brings feedback from the computer informing the student of the correctness of the response. The linear program which used a series of step by step procedures permitted the students to work at their own pace. Each response made by the students was rewarded with immediate feedback (Yasdany 1987).

Alberta Education's policy is to accommodate "students who are disabled, whether physically or emotionally, or have special educational needs that are not always met by regular educational programs. The Special Educational Services branch is responsible for developing the policies which result in the initiation, maintenance and improvement of educational programs to meet those special needs" (Alberta Education, 1983-84, p. 13).

This policy of the Department of Education challenges the teacher with special needs students integrated into a heterogeneously grouped class to develop Individual Educational

Programs (IEP) for each of these students. The aim of this program is to mainstream special needs students in a regular classroom whenever possible and to stimulate optimum learning for these students. Such placements are deemed beneficial to the special needs student as this provides interaction with so called *regular* students and for the student with special needs to experience normal peer socialization. This exposure and integration sensitizes the *normal* student to the needs of others and "should create a bond, and eliminate discrimination against the handicapped" (Schiffman & Bronson, 1984, p. 84).

Research results of Schiffman and Bronson (1984) indicate that special needs, disabled students and slightly mentally handicapped students gain self confidence and self esteem when using computer assisted instruction programs as a learning tool. The use of computers and computer supported resources as an instructional aid in the classroom can help to adjust the learning environment for the special needs student.

Computers are non-judgemental and interaction between the computer and the individual student provides for more equality in learning. The individual differences of students can be

accommodated by the computer as the student is not competing with *normal* students but is permitted to go through the instructional sequence as often as is necessary without feeling self conscious and embarrassed when unsure that the material has been acquired. (Schiffman & Bronson, 1984)

Students with special needs benefit from CAI as well as giving the regular student with ability the right to proceed through the material to be learned at their own speed. (Burke W. 1986) Learning therefore becomes a positive experience and benefits all students. Students who are gifted rate learning using the computer as important and *least restrictive.* Subjects of interest to the gifted student are taken at an enriched or accelerated pace and studied in depth. (Schiffman & Bronson,1984)

Stolurow (1960), who used CAI with mentally handicapped children, found that the less able student would benefit from efficient methods of learning provided by the use of CAI and could become sufficiently indistinguishable from the more able student. The researcher maintained that technology can be used to create programs to accommodate the needs of the individual to provide the potential for mastery learning.

Identifying computer use for the benefit of learning the primary purpose is to identify the *best use* which is dependent on individual needs of the student, the class or a group of students.

Learner Control

Some researchers (Kearsley, 1978; Robson, Steward & Whitfield 1987; Winze, More & Wenzel, 1988) have confronted the question of learner control versus program control in CAI. Kearsley (1978) in his research examined the effects of learner control (LC) vs program control in CAI. The study investigated who should have control over content and path of the instruction the program or the learner. The research also addressed the concern whether instruction could be better adapted to individual differences through the instructor's or student's selection of the management parameter of the program.

Another aspect of the study dealt with task sequencing, instructional strategies and media selection. Three groups of students were involved in the study. One group of students were allowed full control over topic sequencing, instructional mode, amount of practice and level of difficulty. The second group were

given some optional controls over what they were to learn while the third group had no control imposed on them. The computer based course that was used was to teach APL programming language to high school students and university students. The course used by Kearsley in this research was written in the CourseWriter II language.

Instructional design should provide several levels of control during the instruction of a lesson. Students should be able to alter modes of instruction according to their knowledge prerequisites or their level of learning of the instructional concepts. This implies that the learner should have control over three basic features of the instructional objectives established by the program: content, strategies and mastery criterion. (Kearsly, 1978)

> The important implication . . . is that learning must be a cognitively active process on the part of the learner and that students involvement is essential in building a conceptual structure. It follows that students should be given a means of organizing new knowledge in an appropriate way. . . . which allows the student to directly control the acquisition of concepts or rules. (Kearsly, 1978, p. 26)

According to Gray (1987), control can involve time in exercises, choice of sequence, level of difficulty or lesson

completion. Control may only increase positive attitudes toward a learning experience when it is unobtrusively implemented. Too much control of sequence in the program may serve to distract the learner which may cause the learner to make too many difficult decisions. The findings of Gray's (1987) study reported that control of sequencing had a positive effect upon learner comprehension but not on retention.

A follow up study completed by Gray a year later examined the effects of two features of sequence selection menus, broad menu versus deep menu selection. Both of the menus were accessible to students who had control over the sequence of instruction in the CAI program. Results of this study indicated the importance in the menu presentation greatly affected student comprehension, retention and attitude towards CAI. The research findings show student scores were higher for students who were given meaningful menu choices (Gray, 1988). Interpretation of the results of the current study must be done with caution because of the limited interaction with the CAI program and restricted subject selection which may have affected the outcome.

Courseware Design

Treating the curriculum and CAI in terms of design necessitates the developer to consider both the learner and the program. Learner characteristics the developer takes into consideration include external knowledge, attitude and needs of the learner, elements of form such as , structure, style, motivation and sensitivity of CAI. (Duin, 1988)

Duin investigated the effects of a well designed CAI vs. a poorly designed CAI program and found that students who received the well designed CAI outperformed all other groups in quality of prewriting. Subjects were students majoring in a variety of fields who were enrolled in a technical writing course. Twenty nine received well designed CAI, while 29 received poorly designed CAI, 29 received a paper and pencil version of the well designed CAI, and 29 received a paper and pencil version of the poorly designed CAI. Findings reported that students working with the well designed CAI were more involved and interested in the exercises then students working with the poorly designed version of CAI.

The results of this study promote the use of rules, direction and guidelines from research on document and instructional design

when developing CAI. (Duin, 1988) Duin recommended that further research is required to measure and evaluate the effects of CAI on student learning.

Kearsley (1977) divides instructional design into the three features: task analysis, learner analysis and means analysis. An instructional design should involve the interaction of all three features of the design.

Task analysis includes characteristics of different subject matter as well as a particular design of one subject. Factors such as: levels of difficulty, step sizes, sequence of material and the order of organization are elements dealing with the content of the subject material. Another significant factor of task analysis is the development and specification of instructional objectives. Instructional objectives should specify the expected learning outcome after instruction has taken place. Only if objectives are stated clearly and precisely, and are effectively tested, is it possible to ascertain if learning has in fact occurred.

One dimension of learner analysis is the pre-entry skill or behavior of the learner. During the instructional process certain assumptions are made about the skills and abilities a learner

possesses. A student who lacks certain reading or comprehension abilities will not understand the given instruction and therefore will not advance far on the given task. Deficiencies of assumed skills will interfere with the learner's ability to benefit from the instruction to reach the desired learning objectives. Age of the learner is an important dimension of learner analysis, as certain skills and abilities are age dependent. (Bruner, 1967) "It must be determined whether or not the required skills for a task or subject are typically available at the age level of the student. Conversely, the design of instruction should take advantage of the particular skills or abilities available to the learner at a particular age" (Kearsley, 1977, p. 4). A further aspect of learner analysis is the group characteristic of the learner. The design of instructional material for students with physical or mental handicaps as well as other learning disabilities have to be an important concern when developing instructional design. Cultural barriers such as instruction for native or foreign students and differences in abilities and motivation will require special attention to the designing of instructional materials.

Means analysis is concerned with the process necessary to instruct certain tasks. Means analysis concerns itself with the *how* aspect of instruction. The specification of instructional strategies are a significant aspect and "involve the selection of macrostrategies such as group versus individual instruction or expository (tutorial) versus exploratory (socratic) modes, and microstrategies which include the use of techniques such as shaping, fading, prompting, and so on, within any particular macrostrategy" (Kearsley, 1977, p. 6). Designing learner evaluation is another aspect of means analysis. Evaluation effects the feedback, level of difficulty, length of instruction, sequence and remedial or enrichment segments of the instructional design. Maintaining the interest, attention and motivation of the learner must be considered in designing instructional material. Effective learning is the result of the interaction between task, learner and means analysis when included in the instructional design.

Conclusion of Literature Review

> Although computers as a teaching media possess unique and interactive capabilities, they are really only one factor in an array of factors which affect learning.

> These factors not only affect instructional conditions such as the kind of media used and design materials, but also those relating to environmental conditions (class size, teacher expectations), modifiable and non-modifiable characteristics of the learner (intelligence, socio-economic status, study skills), and implementation methods (mix of instructional approaches, time allowed for use). The systematic study of these factors with various kinds of students can bring us closer to a more scientific approach to instruction, and hopefully, result in more effective learning. As efforts are made to increase our data base of information on computer use in education, some specific direction in both research emphasis and methods should be considered. (Roblyer, 1985, p. 27)

Gaining higher standards of cognitive achievement has become a major issue since Alberta Education has increased mandatory course credits for a high school diploma for secondary education students in Alberta (Alberta Education 1988-89). This mandate supports the importance of reaching higher standards of achievement in academic as well as career oriented skills.

The use of computers generally resulted in effecting gains in cognitive, affective and psychomotor domains (Wright, 1987). Apart from the gains in the cognitive domain the use of computers increase a pupil's excitement and enthusiasm towards learning. Wright's (1987) study clearly demonstrated that tutor types CAI

were superior as they produced specific cognitive gains. These results further supported the finding that "basic skills are much more effectively learned when instruction is supplemented by computer assisted instruction (tutor uses)" (Wright, 1987, p. iv).

Past research in the field of computer use in education is necessary for today's researcher to better understand what has happened and what is presently taking place. Although past research is important, it will fade in the face of what is happening right now and what is yet to come. Although the principles learned will prove invaluable in future development and research.

Integrated media, a new term of the past decade, has meaning for industry and education. Using technology to integrate computers with sound, animation, film and interactive mode at all levels is placing computer technology at its optimum use. Lessons to teach concepts of all kinds can already be found in the form of games and interactive simulations at many levels of education, from kindergarten to post graduate university.

CHAPTER III

METHODOLOGY

Introduction

The purpose of this study was to examine the extent to which teacher delivered classroom instruction, supplemented by computer assisted instruction tutorial lessons for Osteology (bone structure) and Myology (muscular system), would enhance student achievement in these two areas of the Beauty Culture 22/32 vocational education program for high school students. The topics and the content for the CAI program were taken from Unit 33 of *The Professional Cosmetologist 3rd Ed.* using the Beauty Culture Curriculum Guide 22/32, a publication of the Curriculum Branch, Alberta Education as guides.

This chapter describes the procedure used to gather data for analysis necessary to provide evidence in relation to the research problem. The study investigated the effects of a CAI program, used to supplement classroom instruction, with experimental groups of

secondary school students enrolled in the vocational education 22/32 beauty culture program.

Selection of Schools

The criteria used to select senior high schools to participate in the research were:

1. The school had to offer an Industrial Education Beauty Culture Program at the 22/32 level;
2. The school had to be equipped with a laboratory of Macintosh Computers[1] that were connected to a Local Area Network[2] (LAN);
3. The students in beauty culture had to have access to a computer laboratory;
4. The school had to be in the Edmonton Metropolitan area;
5. The school had to be accessible to the researcher.

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1 Macintosh computer is distributed and sold by Apple Computer, Inc., P.O. Box 4046, Cupertino, California, 95014-9968, U.S.A.

2 A local area network (LAN) is a means to connect computers, printers and other peripheral devices to a file server which holds information all users connected to the server may use.

Of the 15 composite high schools in the Edmonton Metropolitan area that offer a Beauty Culture Program, three met the established selection criteria (see Table 3.1). Two of these schools were part of a school district that was classified as a smaller

School	Criteria *				Type of District	
	1	2	3	4	Large	Small
A	x	x	x	x	x	
B	x	x	x	x		x
C	x	x	x	x		x

*Key:
1. Beauty Culture 22/32
2. MacIntosh Computer Laboratory/LAN
3. Access to Computer Laboratory
4. Located in Metropolitan Edmonton area

Table 3.1

Participating Composite High Schools

school district and the remaining school was categorized as belonging to a larger school district. Telephone contact was made

by the researcher to arrange an appointment with the principals of each of the three high schools to meet for an information session.

During the information session, the research procedures were outlined by the researcher and the principal was asked to cooperate in the study by signing a letter to grant permission to the researcher to conduct the study (Refer to Appendix A, for a sample letter). In addition a copy of the CAI lesson, contained on a $3^1/_2$ inch computer disk and written instructions on how to use the disk and the CAI lesson, were made available to each principal. The requested permission was readily granted.

Following the meeting with the principals, the researcher phoned the beauty culture teachers in the three schools and provided an overview of the study and their role in it and asked for their participation. In all instances teachers responded favorably to the request of the researcher. Arrangements were made by the researcher to hold an initial meeting with each teacher to describe the study and the role that the teacher and their students would have in the study. Following the initial meeting subsequent meetings were arranged with the teachers to describe the CAI lesson and the procedures that would be used in conducting the study.

The beauty culture teacher in each school and the technician, a non-certificated aide who is a certified beauty culture journeyman and who assists the teacher in a beauty culture laboratory, were given the opportunity to preview the CAI lesson. This preview was made under the guidance of the researcher. As a result of the preview constructive and worthwhile criticism were provided to the researcher. This feedback resulted in changes and modifications to the CAI lesson by the researcher.

Sample

The sample for this study consisted of 47 high school students who were enrolled in Beauty Culture 22, a vocational education course available to grade 11 students in the three participating high schools.

Data in Table 3.2 show the distribution of students in the three schools and the group in which they were placed for the purpose of the research. It should be pointed out, however, that in School A, the largest school, there were 28 students enrolled in two beauty culture 22 classes.

The teacher and researcher elected to divide these students into the experimental and control group. This procedure was followed because the students were reluctant to be placed in the control group. This problem was solved following a discussion with

Table 3.2

Distribution of Study Sample N = 47

School	No. of Students	Group	
		Experimental	Control
A	28	18	10
B	11	7	4
C	8	5	3
Subtotal	47	30	17
Total	47	47	

the teacher. As a result of that discussion the students agreed to draw names. Student names were written on a piece of paper and drawn out of a box by the beauty culture technician. Students whose names were drawn were placed in the control group. Some students

who were absent during the selection process were volunteered by their classmates to be placed in the control group. The control group for this school was smaller than the CAI group because students were eager to be part of the experimental group. As an inducement, it was agreed that students in the control group would have access to the computer lesson following the posttest. In conducting the study, all students received classroom instructions in the form of a lecture on osteology and myology delivered by the teacher. Following the lecture, the control group received the workbook assignment treatment using the prescribed text and the experimental group received the CAI treatment.

Design Of The Study

The researcher used a **pretest/posttest treatment** design to test student cognitive achievement of osteology and myology (refer to Appendix B for sample copy of pretest/posttest). The intent was to measure the student's knowledge level in these two anatomy areas as it related to beauty culture. The classroom teacher was responsible for administering the pre-and-post

achievement tests and maintaining close contact with the researcher.

The content for both the CAI lesson and teacher delivered lesson for this study was taken from Unit 33 of *The Professional Cosmetologist 3rd Ed.* the approved text for Beauty Culture 12/22/32. This particular unit concentrates on the structure of the human body as it relates to cosmetology and includes the fundamental knowledge in anatomy the student must know in order to pass the journeyman examination for beauticians which is administered by the Apprenticeship Training Branch, Alberta Career Development and Employment.

The trade regulations for beauticians specify that to qualify for the beautician journeyman certificate, the applicant must achieve no less than 70% on the examination prescribed by the Alberta Apprenticeship and Trade Certification Board (Section 13[1]), in both theoretical and practical portions of the examination. (Beautician Trade Regulation, 1983). Thus it is important to prepare student's academic skills in the areas of beauty culture related sciences to enable the participants to succeed within this program.

The sample of 47 female students was divided into six groups with two of the groups in the larger school. Both the CAI and control groups received two eighty minute periods of CAI instruction on Osteology and Myology. These lectures were delivered by the classroom teacher. Following the oral presentation by the teacher, the control group reviewed and studied the same content that was presented in the lecture but this group used as reference the textbook and the worksheets. The CAI group also was exposed to the teacher lecture but in lieu of using the printed material for the review substituted the CAI tutorial for Osteology and Myology. The CAI group conducted this review in the computer laboratory for two eighty minute periods.

Treatment

Treatment for those involved in the study, depending on the group, consisted of four of these five components; 1) Pretest, 2) Lecture, 3) Worksheet supplemented with the textbook, 4) CAI, and 5) Posttest. Both the pre-and posttest developed by the researcher were identical paper and pencil tests. The treatment for the control group, following the teacher lecture, used worksheets

supplemented with the text to complete the worksheet. Students in the experimental group, following the lecture, used the CAI tutorial as its study guide.

During the first class of the unit on anatomy the pretest was administered to all students, was marked by the teacher, and scoring was checked by the researcher for accuracy. All students were then presented with two 80 minute period theory lessons on anatomy delivered by the classroom teacher using the lecture method. The following sequence was used by teachers, who taught the theory lessons on sequential days in the three schools. Osteology was taught the first day and Myology was taught the second day. Following the Myology lecture the control group used worksheets with the text as a reference and studied on their own or two separate 80 minute periods. The experimental group used the CAI tutorial for the same time frame.

Prior to being allowed to use the CAI tutorial, the experimental group was introduced to the MacIntosh laboratory under the supervision of the researcher and the classroom teacher. To familiarize each student in this group with the computer, the

participants were permitted to play **Crystal Quest**[3], a computer game. The objective of this portion of the research was to familiarize the students with how to work and manipulate the **mouse.** Each CAI group was allowed 30 minutes of practice time with Crystal Quest before they began the CAI tutorial. Following the theory presentation by the teacher, the control group students went to the library where they worked under the supervision of the Librarian/Teacher and the Beauty Culture Technician on their worksheets with the use of their textbooks.

Facilities

The three schools involved in the research were selected because they met the established criteria for selecting schools. In each school the hardware for the CAI tutorial was located in the Macintosh computer laboratory which was served by a central file server that was connected to a LAN. The configuration of computers in each laboratory in each school was arranged in a different pattern

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3 Crystal Quest, a public domain shareware game created by Patrick Bukland, 1987, 36 Northstreet, Ventnor, Isle Of Wight, England.

(see Appendix C Figures 1, 2 & 3) which represented the physical layout for the computer laboratories.

It was the responsibility of the beauty culture teacher in participating schools to book the computer laboratory in advance to insure that research students had access to the hardware so they could use the CAI tutorial.

Overview of Course Design and Development

Teachers and curriculum developers are continually integrating computer software programs to augment and reinforce instructional content to fulfil curriculum objectives.

Cromer and Steinberger (1989) reported that in "virtually every subject area, that computer technology expands the array and quality of student learning" (p. 8). The trend to individualize learning material suited to each student's unique needs will continue and will be important to develop a wide variety of courseware that includes tutorials, drill and practice as well as evaluation and instructional management programs for instructors (Cromer & Steinberger, 1989).

Before program and lesson planning, a classification of available computer programs, as they related to instruction, was established. Godfrey and Sterling (1982) believe that computer courseware should clarify and instruct if it is to teach the cognitive material to the learner.

According to Alessi and Trollip (1985), computer programs can be placed into one of five basic instruction applications; 1) Tutorial Instruction, 2) Drills, 3) Simulations, 4) Instructional Games, and 5) Tests. Using the classification system developed by Alessi and Trollip the CAI program used in this study was categorized as tutorial instruction.

The development phase of the tutorial used a systematic approach which involved the following integrated stages:

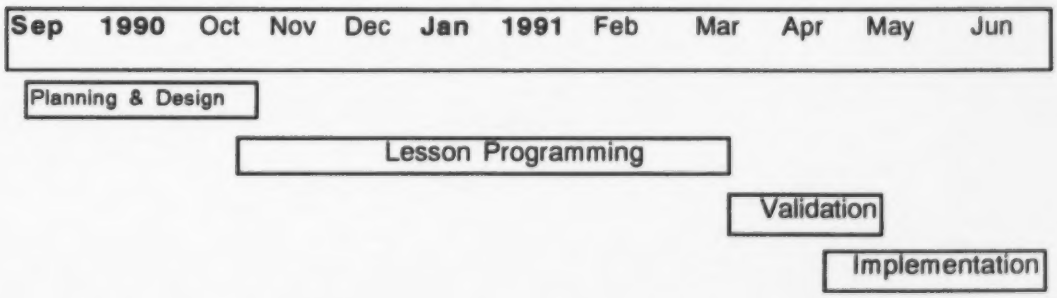

Figure 3.1 Lesson Project Timeline

1. Planning,
2. Design,
3. Program Development,
4. Validation & Evaluation, and
5. Implementation.

In Figure 3.1, it required nine month, September 1990 to April 1991, to plan the tutorial and implement it.

The anatomy lesson for this study was authored by the researcher using as a foundation, content material from the prescribed text and additional resources. From these resources the researcher developed a prototype script outline. This outline specified content, lesson branching, point of interaction and position of test. The general algorithmic design of the tutorial is shown in the flowchart Figure 3.2.

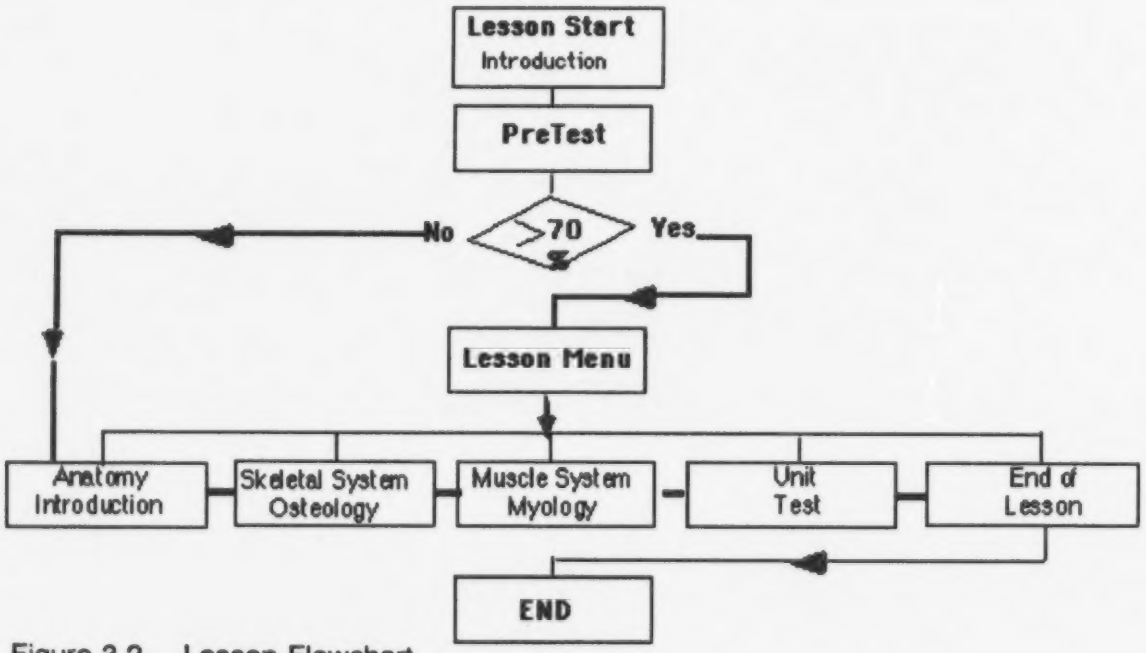

Figure 3.2 Lesson Flowchart

The CAI tutorial was designed using the *Authorware ® Professional™* Authoring System on the MacIntosh II SI computer. Each developmental phase involved discrete tasks such as screen design, entering script, developing graphics, design program branching, as well periodic consultations with subject matter experts to ensure the accuracy of lesson content and design. The organization of the CAI tutorial consisted of three lessons, topics and subtopics shown in Figure 6 found in Appendix C which shows a detailed algorithm of the tutorial.

The structure of the CAI tutorial included the following lessons with these topics and subtopics:

Lesson 1 - Introduction to the study of Osteology (human bone structure).

subtopic 1. Human Bone Tissue

subtopic 2. Bone Joints

Lesson 2 - Osteology (study of the human skeletal system),

subtopic 1. Connective Tissue

subtopic 2. Bones of the Skull

subtopic 3. Bones of Hands and Arms.

Lesson 3 - Myology (study of the human muscular system),

subtopic 1. Muscle Tissue

subtopic 2. Facial Muscles

subtopic 3. Head Muscles

subtopic 4. Muscles of the Trunk and ArmArms

subtopic 5. Hand Muscles

Unit Test - Comprehensive test of all topics and subtopics

End of Lesson - Student is presented with a lesson evaluation, the result of the unit test, how much time the learner took to complete the lesson as well as the date the lesson was completed. Refer to Figure 7 in Appendix D for a detailed CAI tutorial flowchart.

Instructional Design of Lesson

Each lesson was made up of topics and subtopic with its structure similar to the four phases of instruction recommended by Alessi and Trollip (1985). Figure 3.3 presents the algorithm for each subtopic of the tutorial. According to Alessi and Trollip (1985), these phases are: 1) presenting information, 2) guiding the student, 3) practising, and 4) assessing student learning. When teaching new concepts to the learner, the teacher must first present the information. The presentation of the concept may be accomplished in a combination of ways, one of which could be a teacher delivered lecture supplemented with a CAI tutorial.

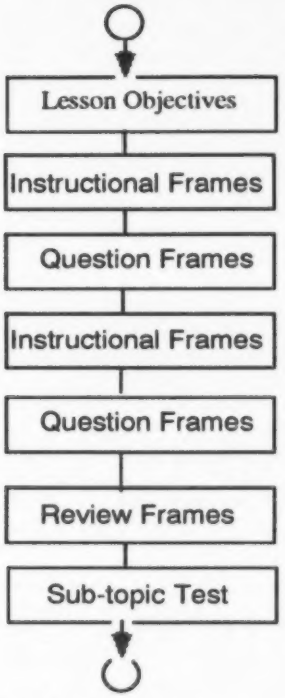

Figure 3.3 Subtopic Design Algorithm

The text of the lesson content of the CAI tutorial was reinforced with graphic displays to present relevant information the student was to acquire. Using this strategy to integrate conceptual pedagogy with graphic displays was an important aspect of the procedures that were used to design the lessons of the tutorial. Bohland (1978) supported this view when he wrote: "a well designed graphic model will help the learner understand

concepts, associations, and underlying theories of a given procedure or process" (p. 202). Kennedy (1974) corroborates the position taken by Bohland when he implies that picture presentations can enhance the retention of information. Sizemore and Pontious (1987) agree with both Bohland and Kennedy and recommend that a combination of tutorial, questions and graphic simulations be used to assist students in learning the required material as well as transferring this new learning to practical situations. Presenting the information was advocated by Alessi and Trollip (1985) to be phase 1, for this study was instructor centred and was presented by the teacher to both the experimental and the control group before the groups divided for the prescribed treatment. Following completion of phase 1, the students entered phase 2 guiding the interactive phase when the student interacted with the CAI tutorial. Subsequent to relevant text and graphics from the tutorial, the student was prompted by the tutorial to perform some type of interaction. The interaction could be in the form of questions. When prompted the student responded to the questions by use of the keyboard to type in the response or to use the mouse to point and click or to drag a graphics/text item to an appropriate place on the

computer screen. Each time the student interacted with the tutorial, the computer would generate some type of feedback or reinforcement. When the student made an error on the first attempt, the tutorial would respond with either a hint to prompt or supply the student with the correct answer. To proceed through the tutorial, the student was required to keyboard in the correct answer. It was necessary for the student not only to be made aware of a correct response but also of their errors and to correct them (Alessi & Trollip, 1985).

The instructional process would not be complete without providing the student with some practice of what had been previously learned. This was accomplished through phase 3, the practice phase, which was student oriented. In phase 3, the student was presented with additional instructional information for each subtopic of the lesson. When the subtopic was concluded, the tutorial presented the student with a review. The student was prompted to practice the previously acquired material by answering questions that supported the objectives established for the sub-topic.

These questions varied with the text and text input as well as with the graphics. The graphics required the student to interact with the program by using the mouse to either point and click or drag an item to the appropriate place on the screen. The program provided feedback which allowed the student to correct an incorrect response as well as giving the student reinforcement for a correct response. The emphasis of the tutorial was on student practice; therefore if the student answered a question incorrectly, the program provided the correct answer. The student was required to input the correct response before proceeding. All student interaction with the tutorial elicited immediate feedback for positive reinforcement during Phase 4, the assessment phase. The comprehensive unit test was administered at the conclusion of the tutorial.

Alessi and Trollip (1985) expressed that the first three phases of the tutorial were considered to be instructional and the last phase was used to assess what learning had occurred. Phase 4 was used to assess student learning to measure learning that was relevant to the instructional objectives that were established for each of the three lessons and their ten subtopics. The result of

testing also provided the teacher with information about the level of learning, the quality of the instructional material, and the need to provide for future instructional needs. Students who were guided through each of the three lessons under the control of the program were presented with the unit test. Students who had passed the pretest of the tutorial had control of the sequence of the lesson which allowed them to take the unit test anytime they chose.

All student responses were stored by the program to provide the student with an end of lesson evaluation. The testing also served a diagnostic purpose for the teacher to determine the individual needs of each learner.

In accordance with Alessi and Trollip's (1985), the model of instruction previously discussed is applicable to classroom instruction. Consequently these modes are also valid for application of CAI tutorials because of the instructional nature of a tutorial. For this research, in addition to teacher dilivered classroom instruction, the computer served as the medium to present all four phases of instruction with the teacher and other media providing support in that learning environment.

Lesson Control

Using the design techniques described in the literature review (Kearsley, 1978; Robson, Steward & Whitfield 1987; Winze, More & Wenzel, 1988) the control of sequence for the tutorial was developed by the researcher. The method used in this study was to determine lesson control to administer a short diagnostic test (pretest) at the introductory level to measure the student's knowledge level of the subject matter. The program was coded to calculate the student's mastery level of the pretest, to determine whether the learner or the program would control the sequence of the lesson.

Student control of the three lessons and their subtopics depended on the scores the student made on the pretest. If the score on the pretest was 70% or above, the student had control of choosing the sequence of the lessons for the tutorial. If the student's pretest score was less than 70%, the program controlled the sequence of the lesson material.

The student had access to a glossary, terms that were related to Osteology and Myology. The glossary was available to the student at any time during the lessons. The student could not access the

glossary during the unit test; at that time, it was disabled. The program permitted the student to exit the system at any time and resume the lesson at the point of exit at any time in the future.

To give the learner control of the sequence of the lessons was a function of the student's ability to make wise choices and the complexity of the subject matter to be learned. Alessi and Trollip (1985) recommended that if the subject matter to be covered was simple, it would allow the more knowledgable student some initial control of lesson sequence by mastering the pretest. Conversely for the less advanced student the program would control the lesson sequence. On the other hand, if the subject matter were complicated, the program should provide the learner with no choices or limited choices over lesson control.

Development of Test Item Components

The instructional units, the three lessons and their subtopics were developed by the researcher and their content was validated with other beauty culture teachers and with the Beauty Culture Curriculum Guide. An important step in the development of the tutorial was to construct a bank of test items from the

instructional content (See Appendix for the test item bank). In constructing the bank of test items the prescribed text and additional beauty culture resource material were used. Each test item was designed by the researcher to fit within the framework of the CAI tutorial and then validated by subject matter experts who were teaching the beauty culture curriculum.

Throughout the development phase of the test bank the test items were edited and revised continuously so that each item included the identification of the following components:

a) body (stem) of the question,
b) body (stem) of the answer,
c) correct answer and decision controls, and
d) feedback for mastery and non-mastery student response.

These test items were developed for use with both on-line computer and paper and pencil format to measure the objectives that were established by the Curriculum Branch for Beauty Culture 12/22.

The test items were pilot tested with beauty culture students who were not involved in the study. These students were encouraged to comment on each test item as well as to make suggestions for change. The test items that were designed were

objective type items that included multiple choice, true and false, and fill in the blank.

Verifying the CAI Tutorial

The evaluation and validation elements of the CAI tutorial served to determine how well the operation and visual effectiveness of each lesson component performed under use. This was accomplished by having other beauty culture teachers and beauty culture students test and retest each lesson before it was used. Throughout the development cycle each lesson was constantly being reviewed by others who recommended to the programmer that data be added, removed or changed. These recommendations were followed.

The final step of the instructional development of the tutorial, before implementation, was the evaluation and revision process. The evaluation process followed the steps recommended by Alessi and Trollip (1985) a) lesson is tested for flawless operation, quality and accuracy of subject matter, b) lesson is taken by other people under the supervision of the programmer to provide feedback on the lesson, c) lesson is tested for instructional effectiveness in an

instructional setting.

The first step for evaluation and testing of the tutorial was the preparation of the evaluation document (see Appendix E) which would serve to record the ratings and comments of the evaluator. This document was developed by the researcher. Testing the three lessons and the subtopics for perfect operation was ongoing throughout the developmental phase of the tutorial. A number of other subject matter teachers and students were involved in this phase of the research before and after each component of the tutorial was programmed into the computer.

For the final evaluation process ten, teachers, two technicians and nine students, were involved. Three of the teachers were subject matter experts in beauty culture, three were English teachers, three teachers taught science, and one was a business education teacher. Other evaluators included two beauty culture technicians and nine grade 12 beauty culture students.

By March 20th, 1991 all those involved in the evaluation process had taken the CAI tutorial and filled out the evaluation document. Only four of the teachers involved in this evaluation provided the researcher with extensive notes and comments that

were relative to this particular project.

Evaluation and Validation Instrument

Title Screen and Sign-On

All those involved with evaluation and validation were of the opinion that the title page and the introduction to the pretest which incorporated graphic animation of a humorous nature had educational value. The sign-on screen asked the user for his/her first and last name which the program stored for subsequent use. Throughout the tutorial the program addressed the learner by name. This feature added a personal touch which participants valued highly.

Screen Displays

Two of the ten teachers rated the font used with the text of the lessons as poor and six rated the font as fair. This criticism was negated by changing the font to one that appeared more clearly on the screen. Text layout and overall appearance for the lesson was rated excellent by seven people and very good by the others. Consequently, the screen displays, except with improving fonts, were not altered.

Subject Matter Content

Two beauty culture teachers and three science teachers rated subject matter content of the tutorial as excellent; one beauty culture teacher rated some of the subject matter as very good; and other teachers rated it as excellent. The content rated *very good* was reviewed and edited by the programmer with the assistance of the beauty culture teacher who rated the content of the tutorial *very good.* The English and business education teachers did not rate the content of the tutorial because it was not within their expertise. Both of the beauty culture technicians and the nine students rated this content as excellent. Two of the students who gave the content an excellent rating were of the opinion that some of the subject matter was too difficult for them to comprehend until they had gone through the instructional material a second time.

Graphic Display

Eight teachers rated the graphics displays as excellent. One of the science teachers thought the clarity and resolution of the bone structure graphics could be improved. This improvement would be considered for the future refinement of the tutorial. One beauty culture teacher found the *tendon* graphic to be misleading. This was

resolved, with the assistance of the teacher, when the researcher made the appropriate changes to the tutorial. All student evaluators rated the graphics as excellent and provided comments such as: "great graphics" , "this is fun", "I love this", etc.

Test Items

The teachers who evaluated the test items found 11 of the multiple choice questions were in need of editing. The researcher made the modifications to these questions according to recommendations made by the teachers. Two of the short answer questions did not accept key terms when the user responded by typing in the correct response. Changes were made to these questions so the program would accept all the required key terms. One person encountered a *matching* question which required the user to use the mouse to *click and drag* a word to the location of the definition of the term. If the user, by mistake, released the mouse button while dragging the term, the program would provide a negative response and record that response as incorrect. The researcher was unable to find a good solution to this particular problem. It was important for the user to complete the *click and drag* without interruption while this task was executed. Two

questions, representing a graphic of the skull, required that the user *point and click* the mouse to identify the location of a bone. This presented a particular problem if the user did not use the mouse carefully. It was found that this graphic would move if a *click and drag* action was used instead of a *point and click* action. This problem was alleviated by using a programming technique that locked the graphic into position regardless of what the user did.

Was the correct answer not accepted

Three of the nineteen evaluators found that some of the correct answers were not accepted. The people who encountered questions that would not accept the correct response made appropriate notations and the corresponding modifications were made to the questions by the researcher to alleviate this problem.

Was a wrong answer accepted?

All participating evaluators answered NO. No changes were necessary.

Is the meaning of the question apparent to you?

All participating evaluators answered YES. No changes were needed.

Please use the space below to provide comments for clarification on:

Sentence Structure, Punctuation, Terminology and Presentation, Style of Text;

The English teachers identified errors in grammar, sentence structure and writing style and made recommendations to correct these errors that were used to edit the tutorial. The other teachers also made corrections that provided alternatives for sentence structure and writing style.

Overall Evaluation

Fourteen of the nineteen evaluators completed the last page of the evaluation form and rated the overall evaluation of the tutorial in this way:

Feedback

Eleven people rated feedback as excellent and two people rated it as very good. One teacher rated feedback as good. One science teacher made the comment that "restating the answer is excellent" in the feedback response. All evaluators appreciated the tutorials ability to address them by name. All students liked the personal touch of seeing their name when the tutorial provided them with feedback to a response. Five people found that the tutorial accepted

minor typing errors and provided the correct spelling.

The evaluation process of this study not only provided information for changes within the tutorial but also gave the researcher valuable feedback on how teachers and students felt about CAI. Although attitude was not measured in this study the researcher felt that the attitude of all participants toward this type of learning experience was positive.

CHAPTER IV

Analysis of Data

The purpose of this study, as outlined in chapter one, was to examine to what extent teacher delivered classroom instruction supplemented by computer assisted instruction would improve student achievement. This chapter presents an analysis of data to answer the research problem. These data were analyzed using a microcomputer spreadsheet and the results are presented in this chapter.

Organization of Sample

The sample consisted of 47 female students from each of three high schools, divided into two groups for each school, one control group and one CAI group. For the purpose of data analysis the control group for each school will be identified by the number 1 and the CAI group by the number 2, i.e., A1= control group and A2= CAI group from School A.

The 47 participating students wrote an identical paper and pencil pretest. The data from these test results form the basis for

	School	Group N	Total N
A	A 1	10	28
	A 2	18	
B	B 1	4	11
	B 2	7	
C	C1	3	8
	C2	5	
			47

Figure 4.1 Number of Students in Groups

analyzing student achievement scores. The total time for the lessons, for both control group and CAI group, included two theory lessons, each eighty minutes long, two CAI tutorial sessions each eighty minutes, for the treatment group and two study sessions, each eighty minutes long, for the control group.

Figure 4.1 represents the distribution of students from the three schools. School A comprised the largest sample, a control

Control Group	CAI Group
10	18
4	7
3	5
17	30

Figure 4.2 Sample Distribution by Group

group of 10 students, and a CAI group of 18 students for a total of 28 students. The 10 students in the control group were all registered in the general high school diploma program. Of the 18 students in the CAI group, one was a TRY[4] student, one student was registered in the advanced high school diploma program and the remaining 16 students were enrolled in the general high school diploma program. Figure 4.2 represents the distribution of students

[4] TRY: Transitional Recommended Year. A program developed at School A for junior high school students in grade 9. Students who participate in this program have not been successful, for various reasons in grade 8, and are given the opportunity in this specially designed course of study to become academically successful.

in the control group and the CAI group.

In School B there were 4 students in the control group and 7 students in the CAI group for a total of 11 students in this sample. The control group in this school consisted of one Academic Occupational (AO)[5] student and 3 students registered in the general high school diploma program. The CAI group included 2 students enrolled in the AO program and 5 students registered in the general high school diploma program.

In School C there were 3 students participating in the control group and 5 students in the CAI group for a total of 8 students. The control group in this school consisted of 1 student registered in the AO program and 2 students enrolled in the general diploma program. The CAI group included 3 students registered in the AO program and 2 students enrolled in the general high school diploma program, for a total of 5 students in this group.

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5 Academic Occupational Program. "The purpose of the Academic-Occupational Program is to provide an alternative to help students who have serious difficulty in keeping up with their peers in regular school courses." (Alberta Education, 1983, P. 53).

Performance Data

Inspection of the data displayed in Figure 4.3 shows that the

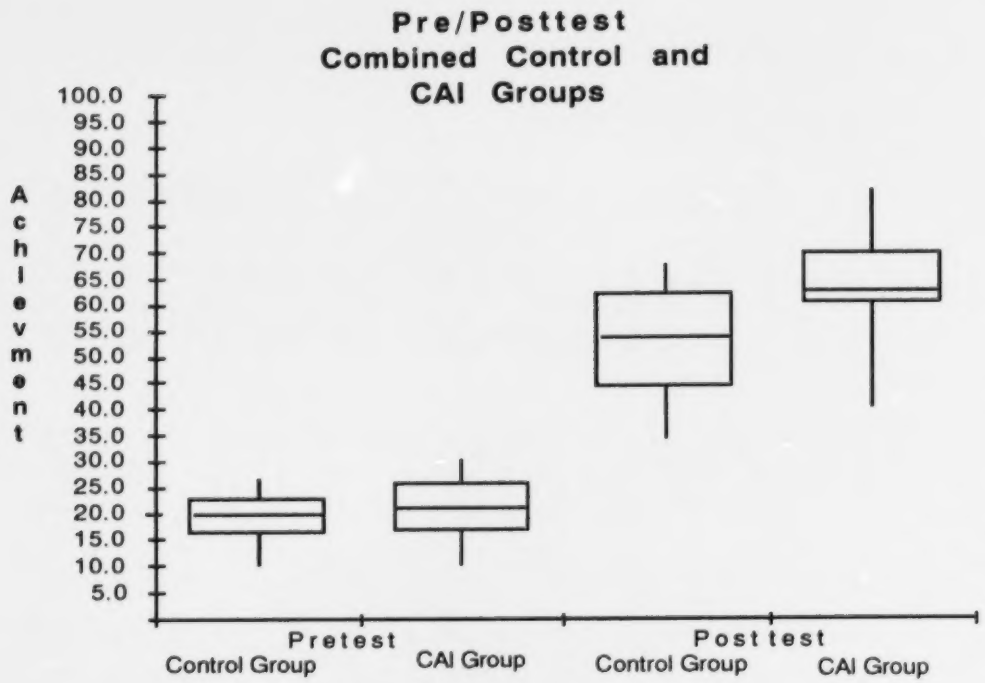

Figure 4.3 Performance Data for combined Control and CAI Group

Box and Whisker Graphing Values for Figure 4.3

N= 47 Control Group = 17 CAI Group = 30	Ctrl. Group PreTest	CAI Group PreTest	Ctrl. Group PostTest	CAI. Group PostTest
Max Value	27.0	31.0	68.0	82.0
Upper Quartile	22.8	25.8	62.0	69.5
Median	20.0	21.5	54.0	62.5
Lower Quartile	16.0	16.3	44.0	60.0
Min Value	10.0	10.0	34.0	40.0

two groups were much alike on the pretest. The values for the bottom of the range and the lower quartile are similar while the median upper quartile and maximum value were all a little higher forthe CAI group. Scores of both the Control and the CAI groups increased markedly on the posttest. However, values for each of the five data points were noticeably higher for the CAI group students than the Control group students. The midspread range increased markedly for the control group on the posttest.

Achievement scores for individual groups in general closely reflected those of the combined Control and CAI groups. Examination of data in Figure 4.4 reveals both groups, the Control group and the CAI group achieved similar scores on the pretest. The maximum value on the posttest was considerably higher for the CAI group than the Control group for the students from School A .

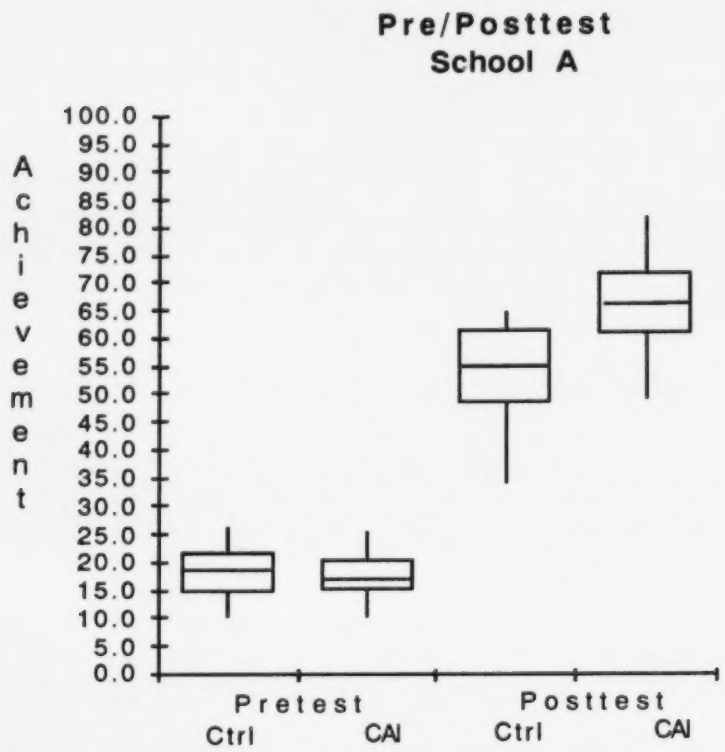

Figure 4.4 Pre/Posttest Achievement Scores School A

Box and Whisker Graphing Values for Figure 4.4

N= 47 Control Group = 17 CAI Group = 30	Ctrl. Group PreTest	CAI Group PreTest	Ctrl. Group PostTest	CAI. Group PostTest
Max Value	27.0	26.0	65.0	82.0
Upper Quartile	21.8	20.5	61.3	71.5
Median	18.5	17.0	55.0	65.5
Lower Quartile	14.5	15.0	48.0	60.3
Min Value	10.0	10.0	34.0	49.0

The groups from School B were smaller than School A. The data observed in Figure 4.5 shows that the values for the minimum

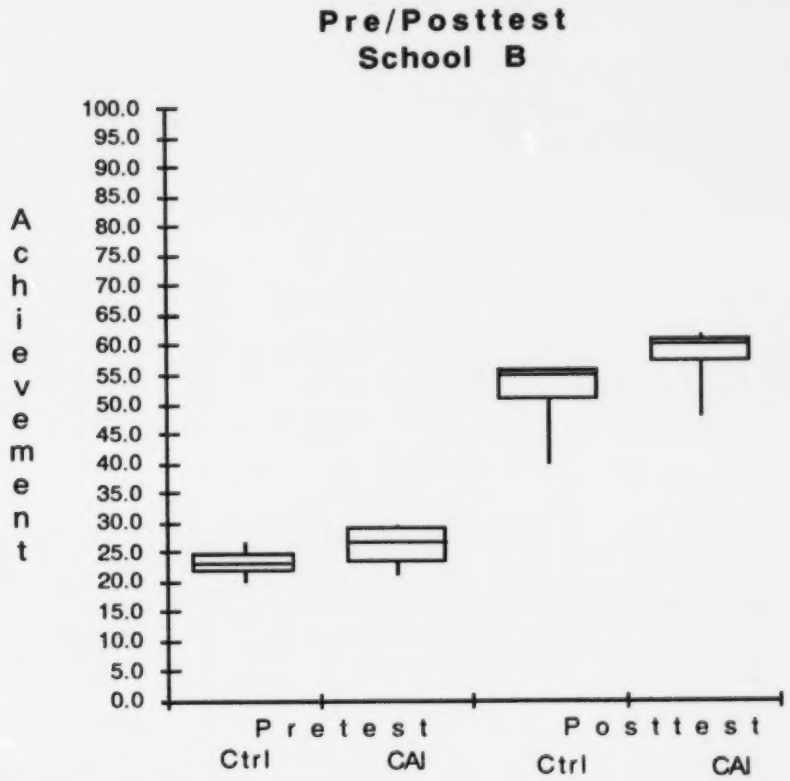

Figure 4.5 Pre/Posttest School B

Box and Whisker Graphing Values for Figure 4.5

N= 11 Control Group = 4 CAI Group = 7	Ctrl. Group PreTest	CAI Group PreTest	Ctrl. Group PostTest	CAI. Group PostTest
Max Value	27.0	30.0	56.0	62.0
Upper Quartile	21.5	23.0	50.5	57.0
Median	23.0	26.0	55.0	60.0
Lower Quartile	24.8	29.0	56.0	61.0
Min Value	20.0	21.0	40.0	48.0

and maximum scores were very much alike for the pretest although the midrange spread was larger for the CAI group. The posttest shows the upper median quartile slightly higher for the CAI group.

Students from School C show a much more diverse distribution

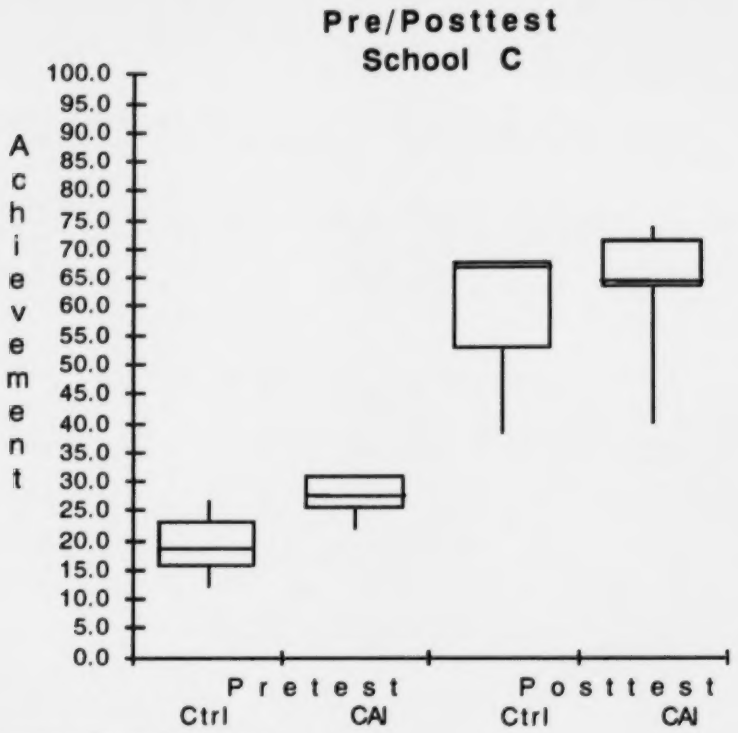

Figure 4.6 Pre/Posttest School C

Box and Whisker Graphing Values for Figure 4.6

N= 8 Control Group =3 CAI Group = 5	Ctrl. Group PreTest	CAI Group PreTest	Ctrl. Group PostTest	CAI. Group PostTest
Max Value	27.0	31.0	68.0	74.0
Upper Quartile	23.0	31.0	67.5	71.0
Median	19.0	27.0	67.0	64.0
Lower Quartile	15.5	25.0	52.5	63.0
Min Value	12.0	22.0	38.0	40.0

of scores on the pretest. The values for the minimum value and the lower quartile were higher for the CAI group on the pretest. On the posttest the difference in achievement was not as spread out as it was on the pretest. Although the CAI group performed better on the posttest than the Control group the difference was not as prominent.

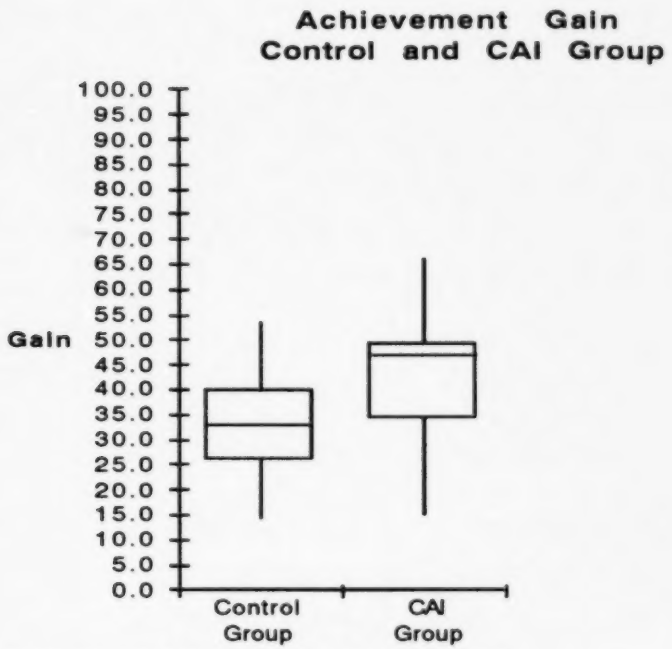

Figure 4.7 Achievement Gain for Control and CAI Group

Box and Whisker Graphing Values for Achievement Gain Figure 4.7

N= 47 Control Group = 17 CAI Group = 30	Ctrl Group	CAI Group
Max Value	54.0	66.0
Upper Quartile	40.0	49.3
Median	33.0	42.0
Lower Quartile	26.0	34.3
Min Value	14.0	15.0

Figure 4.7 displays the achievement gain of the 17 students in the control group and 30 students in the CAI group. Achievement gain for both groups were considerable on the posttest. However values for each of the five data points were noticeably higher for the CAI group.

Performance By Question Type

Multiple Choice Questions

Performance on each of the question types included in the pre-and-posttest is shown in Figure 4.8, 4.9 and 4.10.

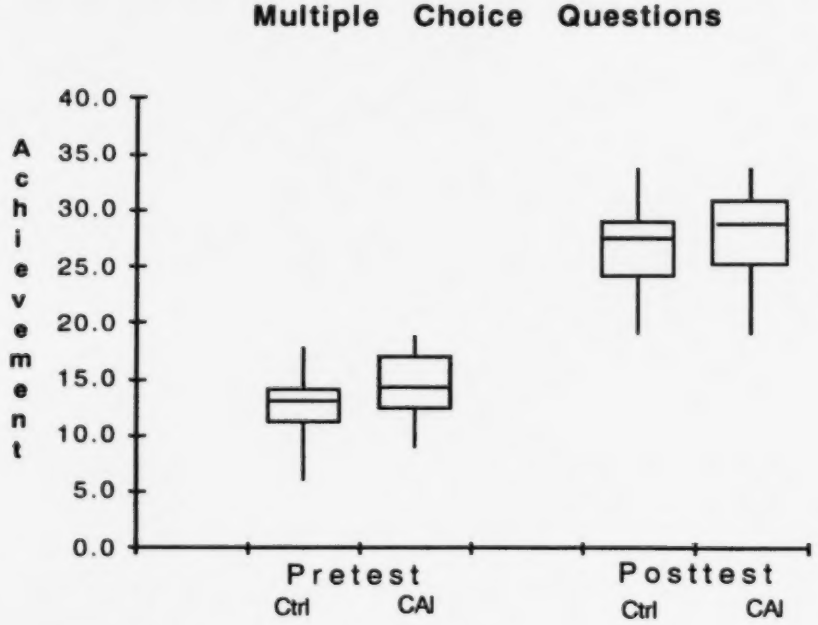

Figure 4.8 Multiple Choice Question Pre/Posttest

Figure 4.8 shows performance on the multiple choice items.

Box and Whisker Graphing Values for Figure 4.8

N= 47 Control Group = 17 CAI Group = 30	Pretest Ctrl	Pretest CAI	Posttest Ctrl	Posttest CAI
Max Value	18.0	19.0	34.0	34.0
Upper Quart	11.0	12.3	24.0	25.0
Median	13.0	14.5	27.0	28.0
Lower Quart	14.0	17.0	29.0	30.8
Min Value	6.0	9.0	19.0	19.0

Posttest scores are considerably higher than pretest scores with some increase in range and an increase in midrange spread for the control groups. The median moved toward the upper part of the midrange spread in both groups.

Short Answer Questions

Figure 4.9 shows performance on the short answer

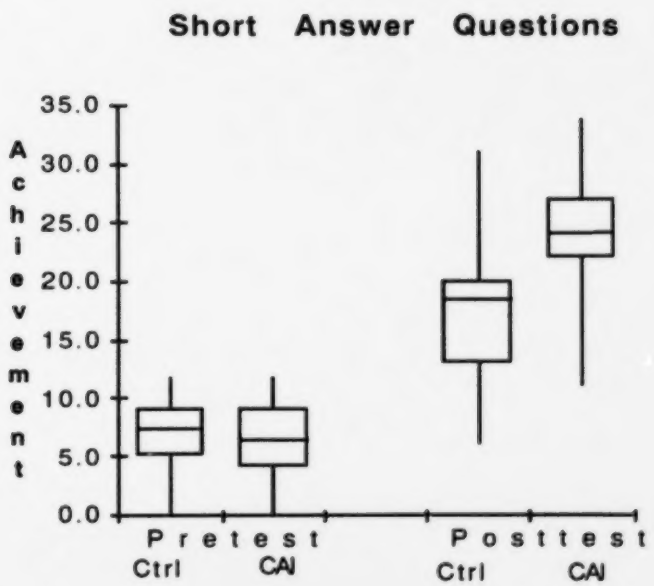

Figure 4.9 Short Answer Questions Pre/Posttest

Box and Whisker Graphing Values for Figure 4.9

N= 47 Control Group = 17 CAI Group = 30	Pretest Ctrl	Pretest CAI	Posttest Ctrl	Posttest CAI
Max Value	12.0	12.0	31.0	34.0
Upper Quartile	9.0	9.0	20.0	27.0
Median	7.0	6.0	19.0	24.0
Lower Quartile	5.0	4.0	13.0	22.0
Min Value	0.0	0.0	6.0	11.0

questions. Performance was about the same on the pretest and increased markedly on the posttest. Scores of the CAI group were noticeably higher than those of the control group on the posttest. The midrange spread of the CAI group was entirely above the midspread range of the control group.

Graphic Labelling Questions

Figure 4.10 shows pretest and posttest scores for the graphic labelling items. These questions were too difficult for students on the pretest and scores were so low that there was almost no distribution. However, the posttest was somewhat less difficult thus, a spread of scores was obtained for both groups. The CAI group did somewhat better than the control group and had a smaller

midrange than the control group. The graphic labelling items of the

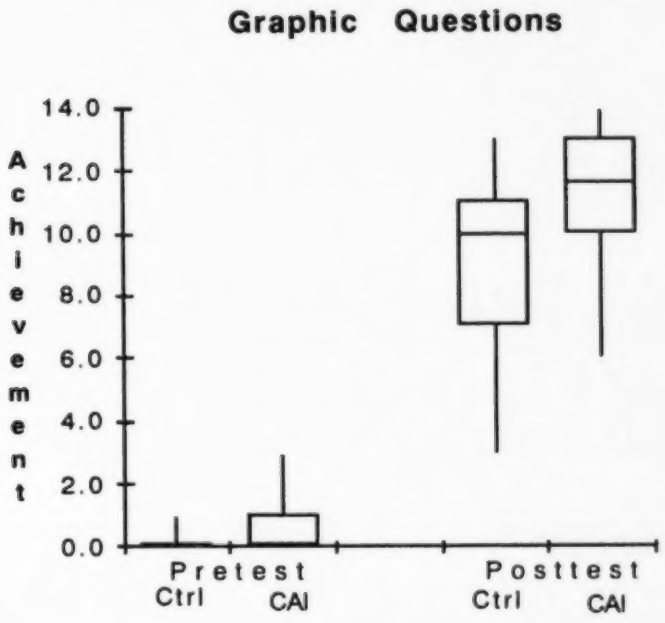

Figure 4.10 Graphic Questions Pre/Posttest

Box and Whisker Graphing Values for Figure 4.10

N= 47 Control Group = 17 CAI Group = 30	Pretest Ctrl	Pretest CAI	Posttest Ctrl	Posttest CAI
Max Value	1.0	3.0	13.0	14.0
Upper Quartile	0.0	1.0	11.0	13.0
Median	0.0	0.0	10.0	11.5
Lower Quartile	0.0	0.0	7.0	10.0
Min Value	0.0	0.0	3.0	6.0

test included visual illustrations, movement and student interaction which might have contributed to the improvement for the graphic

labelling questions.

The results of the data analysis of the present study indicated that students in the CAI groups, using the CAI tutorial in addition to teacher delivered classroom instruction, attained higher achievement scores on the posttest than did the students in the control group. Twenty students in the CAI group showed a notable increase in all segments of the posttest. Students in the control group also showed an increase in the posttest. A possible reason for this increase could be that they were informed they would be part of a research study.

It was important for this study to determine whether using CAI as a teaching tool with vocational education students in secondary education would contribute to higher achievement. The findings of this study suggest that students recieving CAI treatment in addition to teacher delivered instruction attained higher achievement scores on the posttest. These findings are basically consistent with previous research examined by the researcher. The next chapter contains a discussion and summary of these results.

CHAPTER V

Summary, Observations and Conclusions

This study was conducted to determine the extent to which CAI as a tutorial supplemented, by teacher delivered classroom instruction, would contribute to student achievement in the theory portion of Osteology and Myology in Beauty Culture. This chapter presents a summary of the results and the researcher's conclusion based on these findings as well as implications and questions for further educational research in the areas of CAI.

Summary

Instrument

The instrument, a CAI tutorial, for this study was designed and developed by the researcher. The CAI tutorial was programmed using the Authorware® Professional™ authoring software on a Macintosh computer. The CAI tutorial was developed for this study because no tutorial of this kind was available.

Sample

The sample for this study consisted of 47 high school students who were enrolled in Beauty Culture 22, a course in vocational education available to grade 11 students in the three participating high schools.

Research Procedures

This study explored the feasibility, of using the approach of classroom instruction followed by computer study sessions, to improve achievement scores of students enrolled in a high school beauty culture program. Achievement level was determined by pre- and posttest results. The certificated classroom teacher administered the pre-and posttest for both the control and the experimental groups.

The students were presented with two 80 minute classroom lectures on Osteology and Myology. Following the classroom lectures, presented by their teacher, students in the control group reviewed the instructional material for two 80 minute periods using as reference the textbook and worksheets. Students in the CAI group, instead of using the printed instructional materials for review, used the CAI tutorial for Osteology and Myology, in the

computer laboratory, for two 80 minute periods.

Findings

The researcher has looked at the historical perspective, how effective CAI was as a learning tool for secondary students, and advantages and disadvantages associated with CAI. The special emphasis of this research was to explore the strategy of using CAI as a supplement to classroom instruction to determine whether this approach to teaching and learning was a progressive, feasible option for that population.

The findings revealed that all students in the sample achieved higher test scores on the posttest than on the pretest. The majority of students exposed to the CAI treatment achieved higher levels of achievement than students not exposed to the CAI treatment. It seems that CAI as supplement to teacher delivered instruction was an approach to teaching resulting in beneficial results for this sample.

The study also showed that CAI can be used effectively to present the course material in a detailed and stimulating manner which suggest that other CAI programs could be developed to deliver

course material to beauty culture students.

Observations

The following observations were made by the researcher while conducting the study. Although these observations are not supported by research evidence presented in this study it was felt that they contributed to the understanding of the role of computers in teaching and delivery of course material. Both the beauty culture teachers and the students who collaborated in this study were extremely cooperative in all phases of the research.

While supervising the students in the computer laboratory it was observed by the researcher and a teacher in one of the schools that the degree of concentration and motivation the students displayed was highly unusual for this group. After the initial excitement and problems starting the computers, playing the game and commencing with the CAI tutorial, it was observed that students working with the CAI tutorial appeared to be concentrating on their work on the computer. The researcher and teacher observed that the students, while working with the CAI, did not disturb or discuss trivial matters (with each other), as was their usual behavior,

according to their classroom teacher. If they did talk, it was to help each other or make one another aware of a particularly interesting portion of the program. It was observed that there was a period of 25 minutes of complete silence and concentration midway through the first session of the CAI. This quiet concentration was deemed unusual for this group of students according to their teacher.

Recommendations

The primary question remains whether CAI in addition to classroom instruction is more effective with students of diverse individual differences and abilities. In essence, is it conceivable that the use of CAI will yield better results with average students, very bright students or with special needs students? Will students who are more independent learn better with CAI than dependent students? Will students learn better when given more control over the pace of learning and the choice of instructional materials? Are the various types of CAI such as tutorials, drill and practice and simulations, more effective in certain subject areas of education or certain types of learning? Finally, could a well designed primary CAI (using CAI instead of classroom instruction) be used more

effectively than a CAI used as an adjunct?

Thus many more questions have been raised by this research than have been answered. The researcher strongly recommends that only through thorough and well controlled research on the use of CAI in education covering diverse areas and levels of education, can these questions be answered. Undoubtedly CAI will become a major factor in the educational system and the value of it will be determined by how effectively it is used, leading to educational success for each individual user.

Thus the researcher recommends that this study be replicated on a much larger scale, possibly covering all 47 schools in the province of Alberta that offer a vocational beauty culture program at the secondary level.

Conclusions

An important factor should be considered when drawing conclusions from the findings in this study. Some limitations existed in that the total size of the sample was relatively small, thus the CAI treatment groups and the control groups were small making it difficult to draw inferences based on these findings

beyond the present setting. Another factor was the uneven number in the CAI treatment groups and the control groups which may indicate that caution has to be used when interpreting the findings of this study. A further factor is that the CAI treatment groups and control groups in the three school were taught by their respective teachers, therefore allowances have to be made for difference in teaching styles.

Although, computers used as a teaching device posses unique capabilities, they are only one component in a multitude of factors which affect student learning. These factors are not only instructional in nature such as the instructional material and media used, but are also dependent on environmental conditions such as class size, teacher expectations and learner characteristics. The methodical study of all factors with various students and instructional methods will approximate a more scientific approach to instruction and will further effective learning. A good reason for pursuing research in the area of CAI is that it is a study of pedagogy and learning and therefore will benefit all areas of education.

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APPENDIX A

Sample Copy of:

Letters

and

Student Instruction

Sylvia Caforio
18 Woodstock Terrace
Sherwoo Park, Alberta
T8A 4C5

January 24, 1991

Mr.
Principle
Composite High School
Street
Edmonton, Alberta

Dear Mr. . . .:

Currently, I am a teacher at Bev Facey Composite High School (County of Strathcona) and a Graduate Student at the University of Alberta. I am presently enrolled in the Masters of Education Degree Program and have commenced work on a study designed to investigate the effectiveness of computer assisted (CAI) in a beauty culture program.

My study should be conducted during the month of March or April, 1991 within a Grade 11 Beauty Culture program. The topics of the CAI lesson involves the skeletal and muscular lesson of the human anatomy unit as it relates to Beauty Culture. The experiment involves a combination of traditional classroom instruction and the use of CAI in a Macintosh computer laboratory.

I have contacted the beauty culture teacher, who has indicated her interest and enthusiasm in participating in the study during the required time frame. I would like your written approval prior to making further arrangements with the Beauty Culture Teacher for conducting this study.

If you have any further concerns or questions, please contact me at home or at work.

Sincerely,

Sylvia Caforio
B.Ed.

APPROVAL FOR STUDY

I hereby give my approval for Sylvia Caforio to conduct her study in Beauty Culture. The experiment involves students using a Computer Assisted Instruction Tutorial in the Macintosh Laboratory under the guidance of Sylvia Caforio and/or Mrs.. . . , Beauty Culture Teacher

Mr.

Principal

.. Composite
High School

Date:

STUDENT INSTRUCTIONS

Dear Student;

Thank you for participating in this project. The following instruction will help guide you through the computer lesson.

How to start the computer:

You will each have your own start-up disk. Please write your name on the label of this disk.

1. Place the disk inside the disk drive of your computer, e.g.

2. Reach around the left side on the back of the computer and switch it on or if the computer is on simply wait for the screen to clear until you see a window with ANATOMY START.

3. Place the mouse icon on the file LESSON START and double click the mouse button.

This procedure will start the ANATOMY LESSON.

Any time you do not want to continue with the lesson you have the option to quit. The option to quit is in the File at the top of you screen, simply place the mouse icon on the File press down on the mouse button and drag down to select thew Quit option. At this point the lesson will stop.

QUITTING THE LESSON

GO TO **FILE** AND DRAG THE MOUSE TO **QUIT**

YOU HAVE TO DO THIS THREE TIMES

RETURN TO LESSON

REPEAT TO STEP 3 OF THE INSTRUCTIONS

PROBLEMS ENCOUNTERED

If you re-start the lesson and you get a blank screen select Quit from the File option and double click on ANATOMY LESSON Icon on your screen.

If this still does not return you to your lesson quit again and double click on the System Folder. In here you will find a folder called RunAPM Data. Place the mouse icon on this file folder and drag it to the trash can at the right lower corner of your screen, e.g.

The next step is to double click on the file ANATOMY START, this will start your lesson over again.

APPENDIX B

Pretest/Posttest

PRE-TEST / POST-TEST

BEAUTY CULTURE

OSTEOLOGY - MYOLOGY

STUDENT NAME _____

GRADE _____

DATE _____

NAME OF SCHOOL _____

ANATOMY AND PHYSIOLOGY IN COSMETOLOGY:
BONE STRUCTURES and MUSCLES

Multiple Choice Questions. Please read the following question very carefully and then select the best possible asnwer.

1. The term physiology relates to the function of the

   a) skin
   b) body
   c) glands
   d) scalp

2. The skeletal system of the human body is important because it:

   a) covers and shapes the body
   b) supplies the body with blood
   c) provides the framework for the body
   d) carries nerve messages

3. The wrist bones are called:

   a) metacarpal bones
   b) carpal bones
   c) digital bones
   d) radial bones

4. The function of bone is to:

a) stimulate blood circulation
b) expand muscle
c) contract muscle
d) support

5. The ability of one part of the body to communicate with another part is provided by which system:

a) endocrine
b) vascular
c) muscular
d) nervous

6. Tissue that binds, protects, and nourishes the body is called

a) connective
b) nervous
c) endocrine
d) none of the above

7. Bones, ligaments and cartilage are examples of what kind of tissue:

a) connective
b) adipose
c) corrective
d) epithelial

8. Osteology relates to which system of the body:

a) vascular
b) skeletal
c) nervous system
d) muscular

9. Cancellous tissue is usually found on the inside of:

a) end of round bones
b) flat bones
c) oval bones
d) a and b are correct

10. What is name of the yellow fluid substance that serves as a cushion, and lubricates long bones:

a) periosteum
b) sheath
c) synovial
d) corium

11. Blood nourishes the inner layers of the bone by flowing through vessels found in the:

a) cancellous tissue
b) compact tissue
c) periosteum
d) marrow

12. Bands of connective tissue that support and hold bones in place are the:

a) cartilage
b) ligaments
c) compacts
d) attachments

13. To prevent friction during movement, joints are lubricated by:

a) oil
b) inorganic fluid
c) synovial fluid
d) cranial fluid

14. The single name given to all the bones that form the head is the:

a) epicranius
b) cranium
c) occipital
d) skull

15. The cranium is formed by the meeting of two bones that form the top and sides of the head. They are the:

a) temporal bones
b) lacrimal bones
c) zygomatic bones
d) parietal bones

16. The butterfly-shaped bone located at almost the exact center of the head is the:

a) concha
b) nasal
c) ethmoid
d) sphenoid

17. The bone that forms the upper part of the jaw is the:

a) zygomatic
b) frontal
c) mandible
d) maxillae

18. The U-shaped hyoid bone is located in the:

a) pharynx
b) larynx
c) sternum
d) carpals

19. The breastbone is also called the:

a) corium
b) zygomatic
c) sternum
d) trunk

20. Clavicles are commonly called the:

a) ribs
b) metacarpals
c) collarbones
d) shin bones

21. The large bone of the upper arm is the:

a) humerus
b) radius
c) occipitalis
d) temporalis

22. Phalanges of digits are found in the

a) toes
b) fingers
c) ears
d) eyes

23. The bone on the thumb side of the forearm is the

a) ulna
b) radius
c) humerus
d) clavicle
e) scapulae

24. Myology is the study of the

a) bones
b) nerves
c) muscles
d) blood

25. The term muscle is described as a

a) bundle of tough elastic fibers
b) body peripheral tissue
c) tendons that connect bones
d) union of movements

26. The type of muscles that we voluntarily control are called

a) smooth
b) striated
c) non-striated
d) cardiac

27. Cardiac muscle tissue is found only in the:

a) scalp
b) palms
c) lungs
d) heart

28. The muscle attachment that moves the most when the muscle is flexed is called the:

a) axial
b) origin
c) insertion
d) cardiac

29. The frontalis and occipitalis muscle form the:

a) skull
b) head
c) epicranium
d) masseter

30. The orbicularis oculi muscle:

a) closes the eyelids
b) clenches the hand
c) closes the lips
d) bends the elbow

31. The large muscle that raises the eyebrows and wrinkles the forehead is the:

a) corrugator
b) oculi
c) frontalis
d) occipitalis

32. The corrugator muscle is used to:

a) smile
b) shake hands
c) shrug the shoulders
d) frown

33. The frontalis is a muscle that closes the:

a) eyelids
b) lips
c) fist
d) jaw

34. The sternocleidomastoideus muscle is located in the:

a) forehead
b) nose
c) mouth
d) back

35. The point of muscle attachment that moves the least is known as the:

a) axial
b) origin
c) insertion
d) movement

36. The muscle used to pucker the lips is the:

a) orbicularis oculi
b) orbicularis oris
c) levator labii superiors
d) levator anguli oris

37. The depressor labii inferior muscle:

a) lowers the forearm
b) forms the orbits
c) raises the upper lip
d) lowers the lower lip

38. The buccinator muscle is located in the area of the:

a) mouth
b) nose
c) ear
d) nape

39. When smiling the muscle that pulls the corners of the mouth up is the:

a) temporalis
b) platysma
c) masseter
d) risorius

40. The smooth, elastic tissue that acts as a shock absorber between bones is called:

a) marrow
b) cartilage
c) ligament
d) epithelial

Short Answer Questions. Please write your answers to the questions in the space provided.

1. Why is it important that the cosmetologist have a good understanding of human anatomy and physiology?

/ 3

_____

_____

2. The scientific study of bone, their function and structure is called:

/1._____

3. Define ANATOMY:

/ 2

_____

_____

4. Name the five areas of the body the cosmetologist is concerned with:

/ 5

_____

_____

5. Define the term PHYSIOLOGY:

/ 2

_____

_____

6. The physical foundation of the body is the skeletal system, what is it composed of?

/ 1

_____

7. Bone is composed of two types of matter, name them:

/ 2

_____

8. List four functions of bone:

/ 4

1)_____ 2)_____

3)_____ 4)_____

8. The skeleton of the head is called: _____

10. How many bones are contained in the facial skeleton: _____

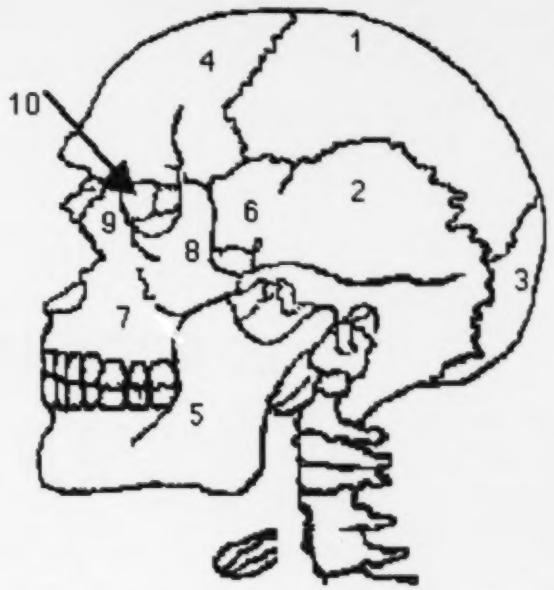
11. The bone that joins together all bones of the cranium is called:

/ 1

_____

12. Please label the following diagram of the skull:
/10

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____



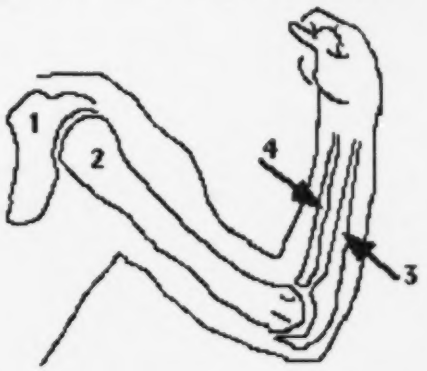
13. Identify and label the arm bones of the following diagram:

1._____

2._____

3._____

4._____



14. The scientific study of the structure, function and disease of muscles is called:
/ 1

_____

15. How many muscles are there in th human body?_____

16. List three kinds of muscle tissue:
/ 3

1._____

2._____

3._____

17. When muscles contracts, the part of the attachment which remains fixed is called: _____ and the part which moves is called _____.

18. The cosmetologist frequently provides scalp massage services, name the two important muscle of the epicranius:
/ 2

1)_____ 2)_____

19. Which muscle lifts the eyebrows?
/ 1

_____

20. Name the muscle which flexes the head, e.g. nodding:
/ 1

_____

21. Name the tendon which connects the epicranius muscles:
/ 1

_____

APPENDIX C

Computer Laboratory Layouts

Laboratory Layout School A

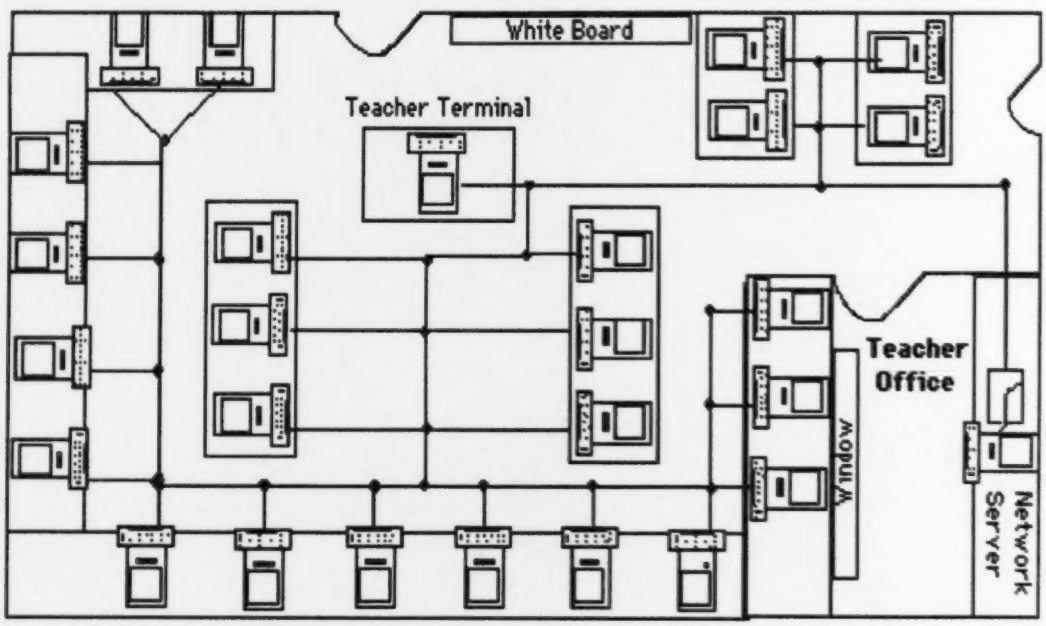


Figure 4 School A, Macintosh Computer Laboratory Layout.

Laboratory Layout School B

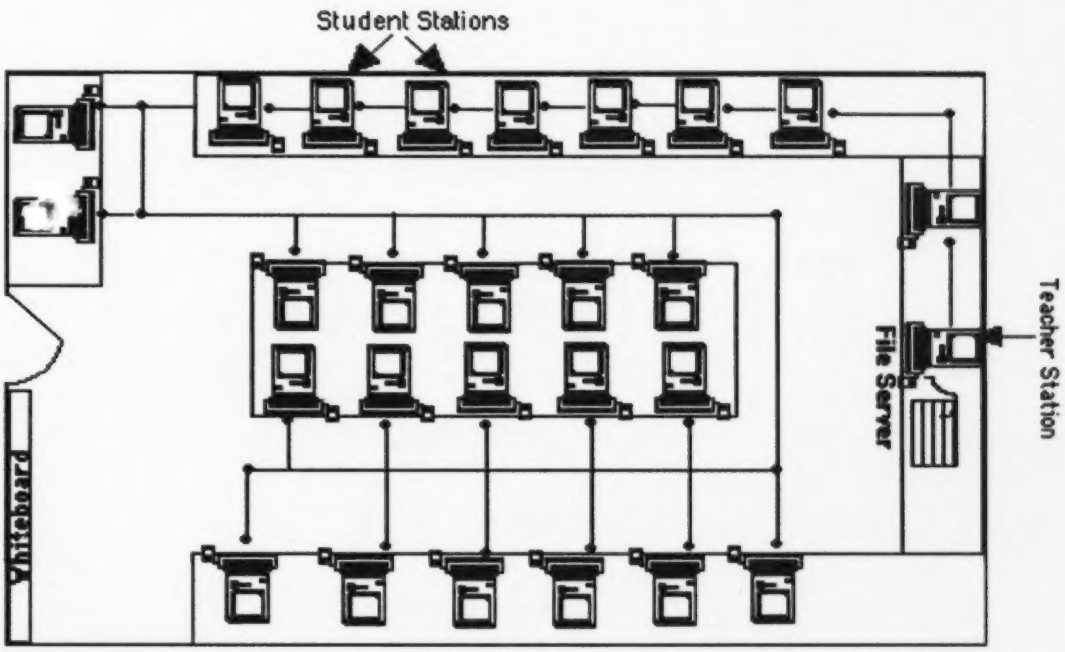


Figure 5 School B, MacIntosh Computer Laboratory

Laboratory Layout School C

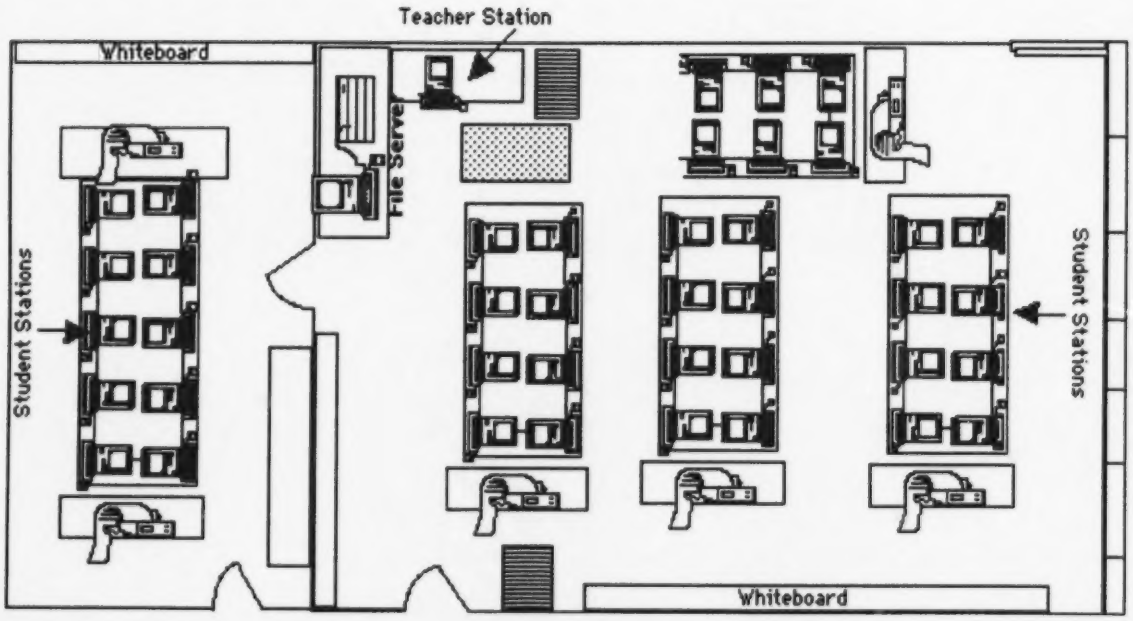


Figure 6 School C, Macintosh Computer Laboratory Layout.

Appendix D

CAI Flowchart

CAI Tutorial Flowchart

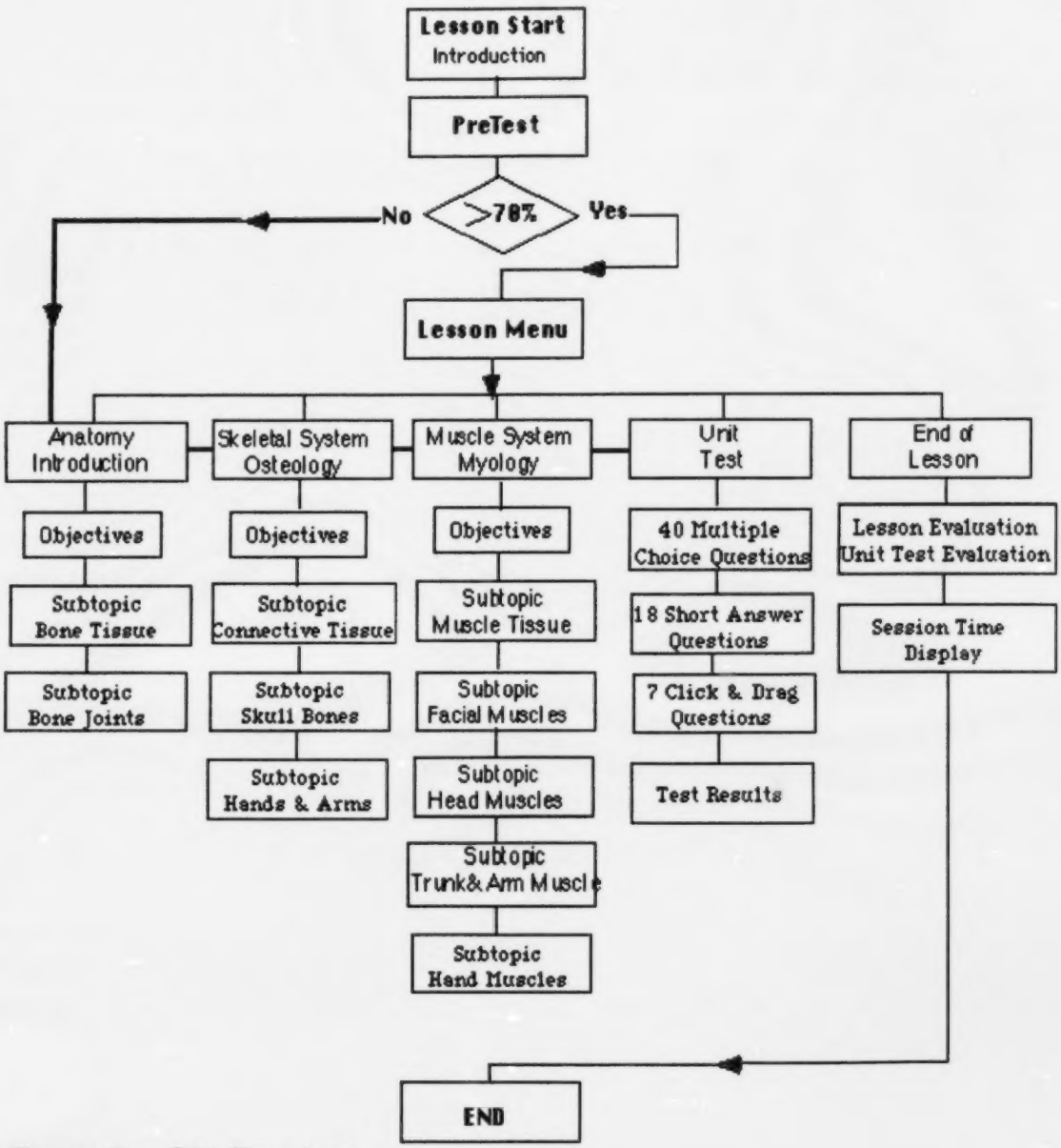


Figure 7 CAI Flowchart

Appendix E

Evaluation/Validation Document

VALIDATION AND EVALUATION
FOR COMPUTER ASSISTED INSTRUCTION
TUTORIAL
IN ANATOMY FOR
BEAUTY CULTURE STUDENTS

NAME OF EVALUATOR _____

SOFTWARE: Tutorial for Beauty Culture in Osteology and Myology

AUTHOR: Sylvia Caforio
Graduate Student, University of Alberta

Supervising Professor: Dr. M. Petruk

Reason for Development of Tutorial: Explorative Study for M.ED. Program at the University of Alberta.

System Requirements: Macintosh Computer with 1 Megabyte of RAM and/or MacIntosh Network System.

GUIDE FOR EVALUATOR

The instructional format of this tutorial focuses on the technological capability of the computer to present the pedagogical content of the Anatomy Lesson for Beauty Culture students.

The lesson presents text, graphics, limited graphic animation, questions and feedback to the student.

The lesson provides some interaction and feedback which the user should find reasonably easy to accomplish.

The purpose of this project is to determine the instructional effectiveness of this tutorial.

Give a written evaluation of the screens you feel need commenting on. When referring to a screen please write down the number of the screen, which is located, in the upper right hand corner of each screen.

Please use the following rating when completing the evaluation:

1	Unacceptable
2	Fair
3	Good
4	Very Good
5	Excellent
N/A	Not Applicable

Use the Comment Box or any space available for comments you might have.

SCREEN NUMBER ☐

Rating Scale

1 Unacceptable
2 Fair
3 Good
4 Very Good
5 Excellent
N/A Not Applicale

	1	2	3	4	5	N/A	Comments
SCREEN DISPLAY							
Text Layout							
Font Type							
Readability							
Overall Appearance							

	1	2	3	4	5	N/A	Comments
SUBJECT CONTENT							
Comprehensibility							
Objectives Addressed							
Relevancy to Topic							
Accuracy of Content							

	1	2	3	4	5	N/A	Comments
GRAPHIC DISPLAY							
Screen Layout							
Visual Effectiveness							

	1	2	3	4	5	N/A	Comments
QUESTIONS if applicable							
Easy to understand							
Positive Feedback if encountered							
Negative Feedback if encountered							

Was the correct answer NOT accepted OR Was a wrong answer accepted — YES ☐ NO ☐

Is the meaning of the question apparent to you? — YES ☐ NO ☐

Please use the space below to provide comments for clarification on:

Sentence Structure _____

Punctuation _____

Terminology _____

Presentation Style of Text _____

OVERALL EVALUATION

Rating Scale
1 Unacceptable
2 Fair
3 Good
4 Very Good
5 Excellent
N/A Not Applicale

Please comment in the space provided:

I **FEEDBACK**

In your opinion does the feedback promote:

	1	2	3	4	5	N/A	Comments
Desire for improvement							
Positive feeling about self							
Positive feeling about content							
Positive feeling about the course							

	Sometimes	Always	Never
I Is the program tolerant of minor spelling errors in responses?			
Is the student given direction as to specific forms of input needed?			

II **Summary Feedback at conclusion of Tutorial**

Is the concluding feedback providing you with results from the:

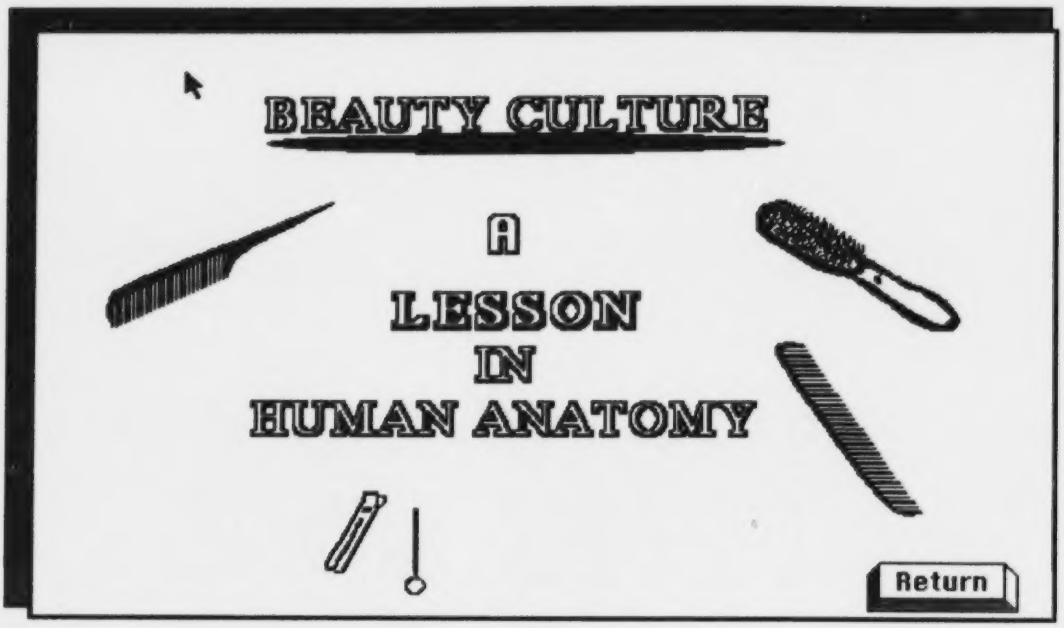
	YES	NO
PRETEST		
Introduction		
Bones		
Moscles		

III Rate the following items in terms of the overall courseware:

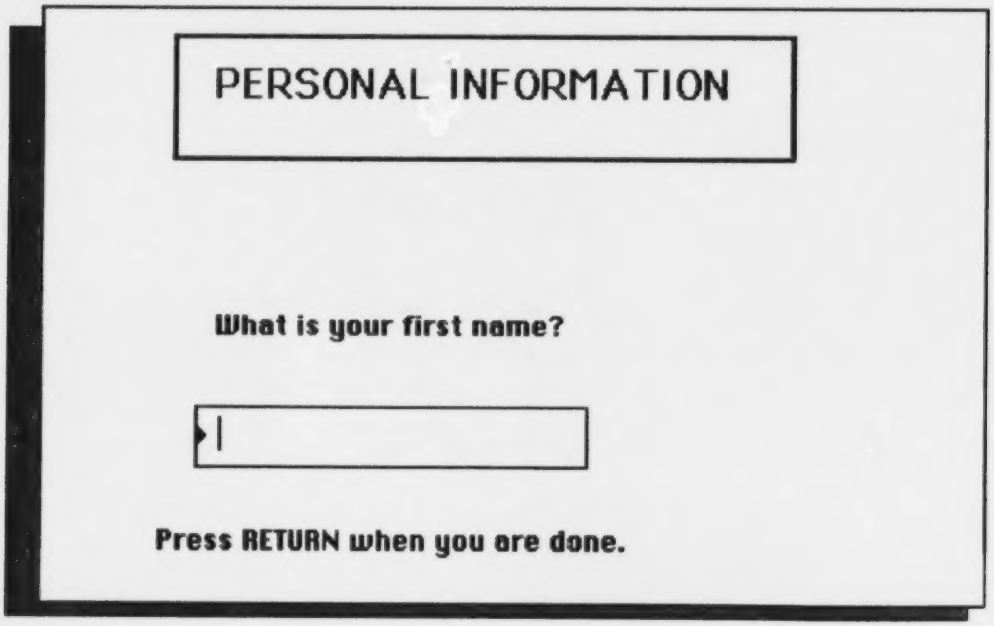
	1	2	3	4	5	N/A	Comment
Attractiveness of screen:							
Suitability of language level:							
Appropriateness of feedback:							
Are questions appropriate to content?							
Is content of feedback encountered appropriate?							
Usefulness of gra[hics relative to the objectives taught:							
Is there sufficient interaction to promote student participation?							
Is the material presented generally of insttructional value?							

APPENDIX F

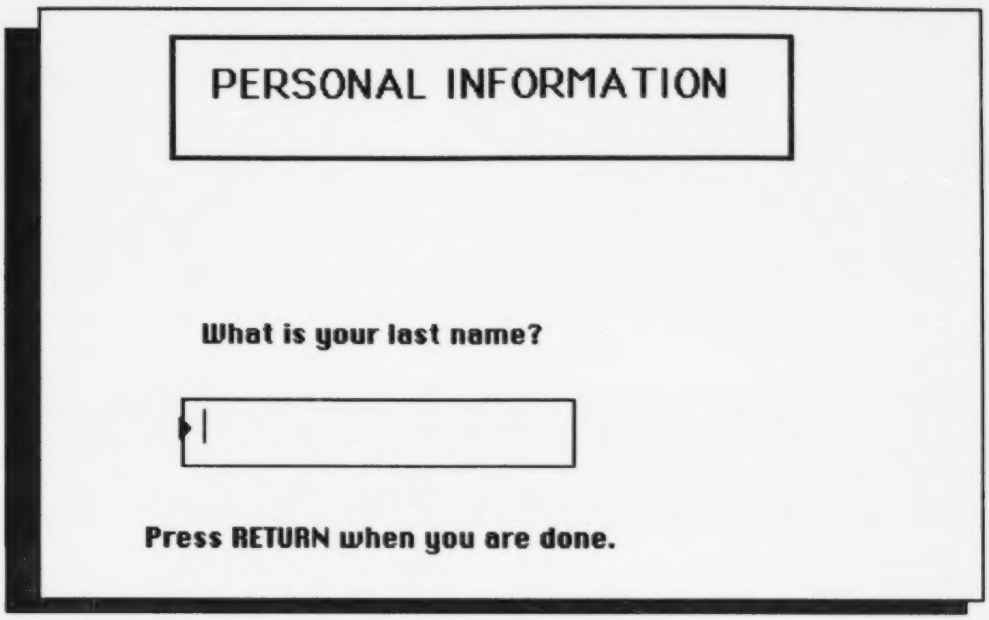
CAI Lesson Sample Pages



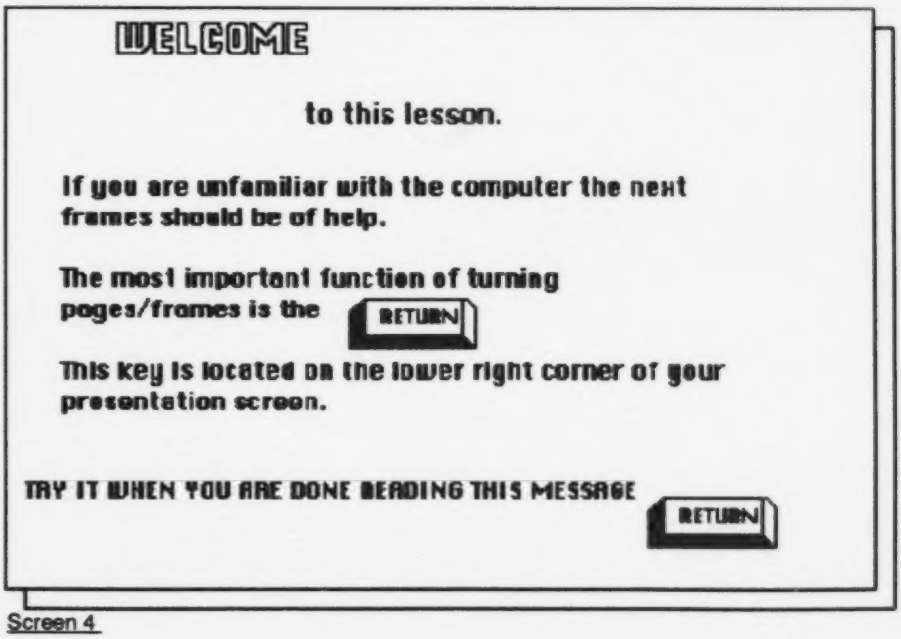
Screen 1



Screen 2



Screen 3


WELCOME
to this lesson.
If you are unfamiliar with the computer the next frames should be of help.
The most important function of turning pages/frames is the
RETURN
This key is located on the lower right corner of your presentation screen.
TRY IT WHEN YOU ARE DONE READING THIS MESSAGE
RETURN

Screen 4

HOW TO USE THE MACINTOSH COMPUTER

Look to the top of your screen and you will find
the Macintosh apple symbol:

File HELP

Return

Screen 5

HOW TO USE THE MACINTOSH COMPUTER

File HELP

These are PULL-DOWN PROGRAMS

The function of File is to give you the option to quit the program any time you want.

HELP will contain information such as how to use the mouse pointer and a GLOSSARY.

The GLOSSARY is inactive if you are in a test.

Return

Screen 6

HOW TO USE THE MACINTOSH COMPUTER

File HELP

In the HELP menu you also find RESUME LESSON

After you are done looking at the GLOSSARY you return to the HELP menu and select RESUME LESSON, this will get you back to the lesson where you left off.

Return

HOW TO USE THE MACINTOSH COMPUTER

When a small black triangle with a rectangular box appears:

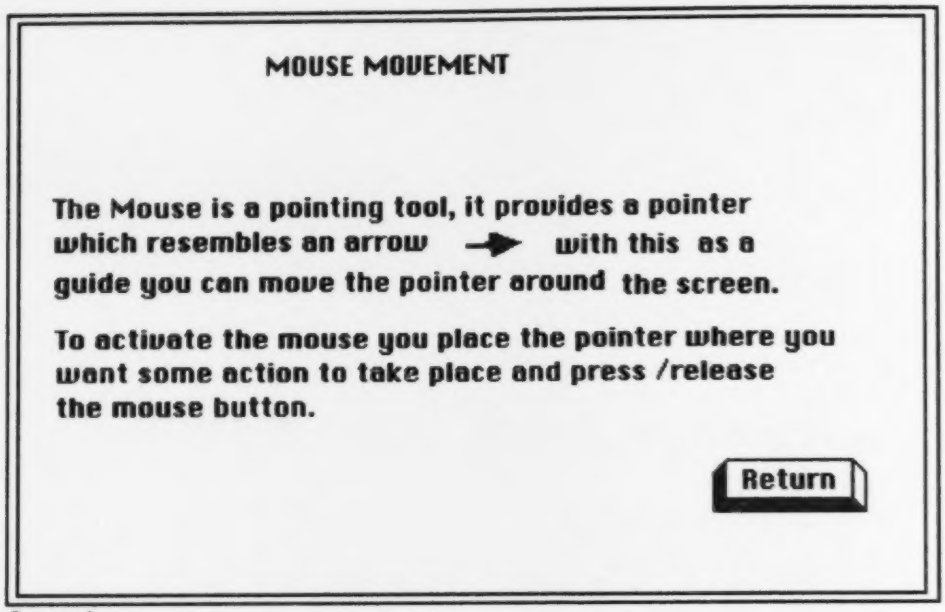
e.g.

you are expected to type in a response from the keyboard and press the key labeled RETURN to have your answer evaluated.

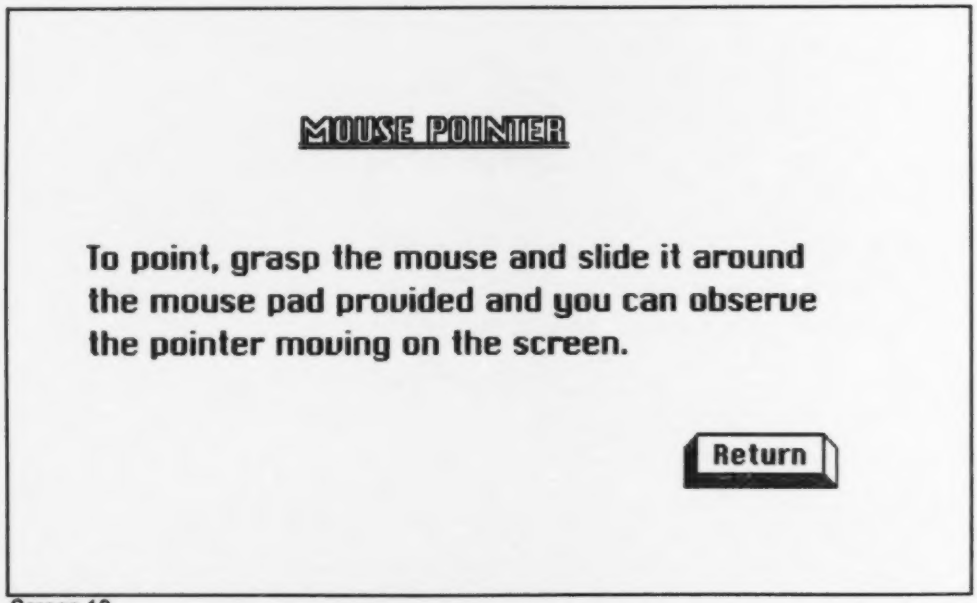
If you are ask to reply with a mouse click, you also have the option to use the letter or number used in the question.

TRY IT NOW, please click the mouse to continue..

Return


MOUSE MOVEMENT
The Mouse is a pointing tool, it provides a pointer which resembles an arrow → with this as a guide you can move the pointer around the screen.
To activate the mouse you place the pointer where you want some action to take place and press /release the mouse button.
Return

Screen 9


MOUSE POINTER
To point, grasp the mouse and slide it around the mouse pad provided and you can observe the pointer moving on the screen.
Return

Screen 10

MOUSE POINTER

Move the mouse until the tip of the pointer is on the area or item you want.

The click the mouse button requires that you hold the mouse steady and quickly press and release the mouse button.

Some items may require a double click, press and release the mouse button twice very quickly.

Return

Screen 11

POINTS TO REMEMBER WHEN USING THE MAC

When you have finished studying the text material or answering a question, press the RETURN button or click the MOUSE.

To use the pulldown menu, move the MOUSE CURSOR to the menu item (top of screen), click and hold the mouse button and drag the cursor down until the selection you want is darkened, and release the button.

Return

Screen 12

MOUSE POINTER

Move the mouse until the tip of the pointer is on the area or item you want.

The click the mouse button requires that you hold the mouse steady and quickly press and release the mouse button.

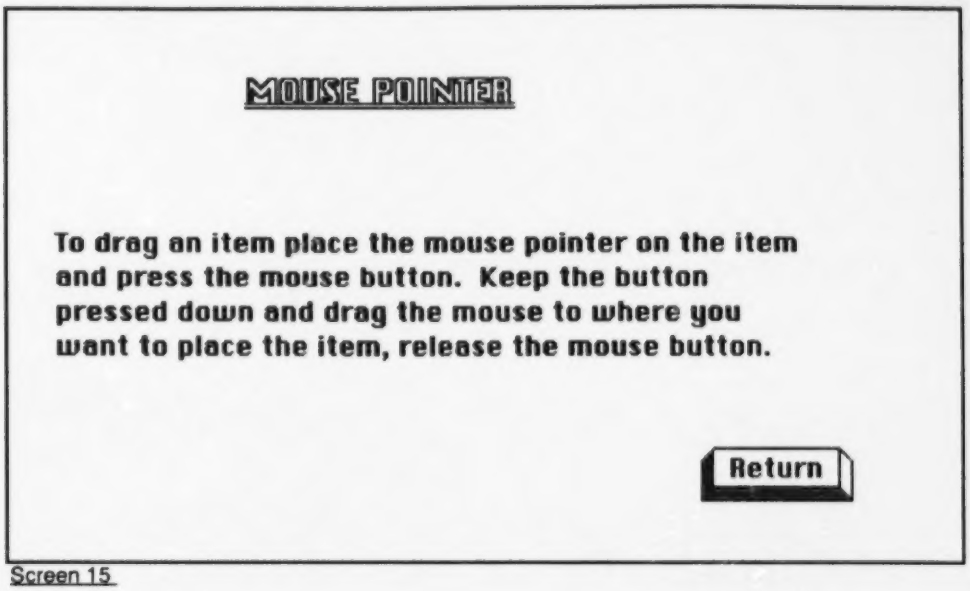
Some items may require a double click, press and release the mouse button twice very quickly.

Return

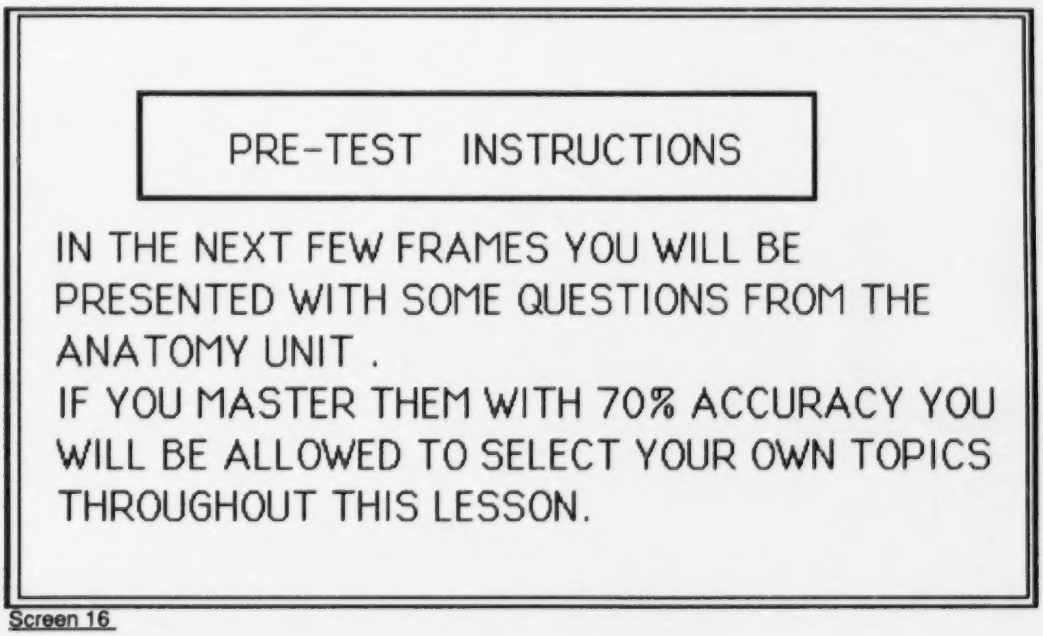
MOUSE POINTER

To point, grasp the mouse and slide it around the mouse pad provided and you can observe the pointer moving on the screen.

Return


MOUSE POINTER
To drag an item place the mouse pointer on the item and press the mouse button. Keep the button pressed down and drag the mouse to where you want to place the item, release the mouse button.
Return

Screen 15


PRE-TEST INSTRUCTIONS
IN THE NEXT FEW FRAMES YOU WILL BE PRESENTED WITH SOME QUESTIONS FROM THE ANATOMY UNIT .
IF YOU MASTER THEM WITH 70% ACCURACY YOU WILL BE ALLOWED TO SELECT YOUR OWN TOPICS THROUGHOUT THIS LESSON.

Screen 16

TEST INSTRUCTIONS CONTINUED...

Sylvia you will be presented with 10 multiple choice question.

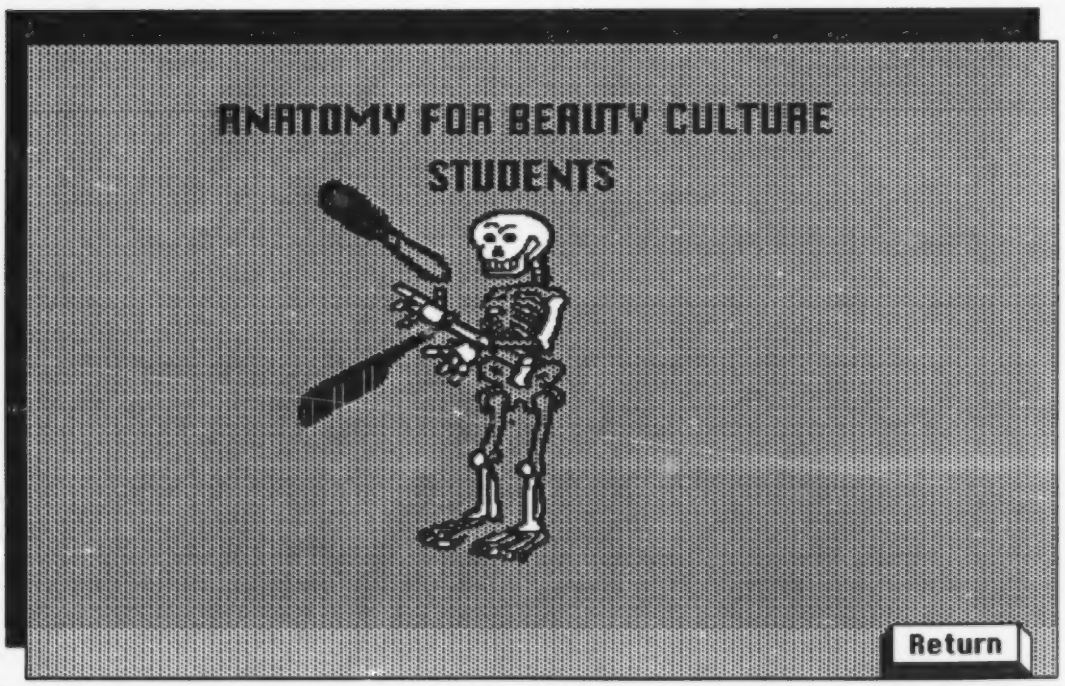
You have the option to respond by pressing the keys: A, B, C or D

or

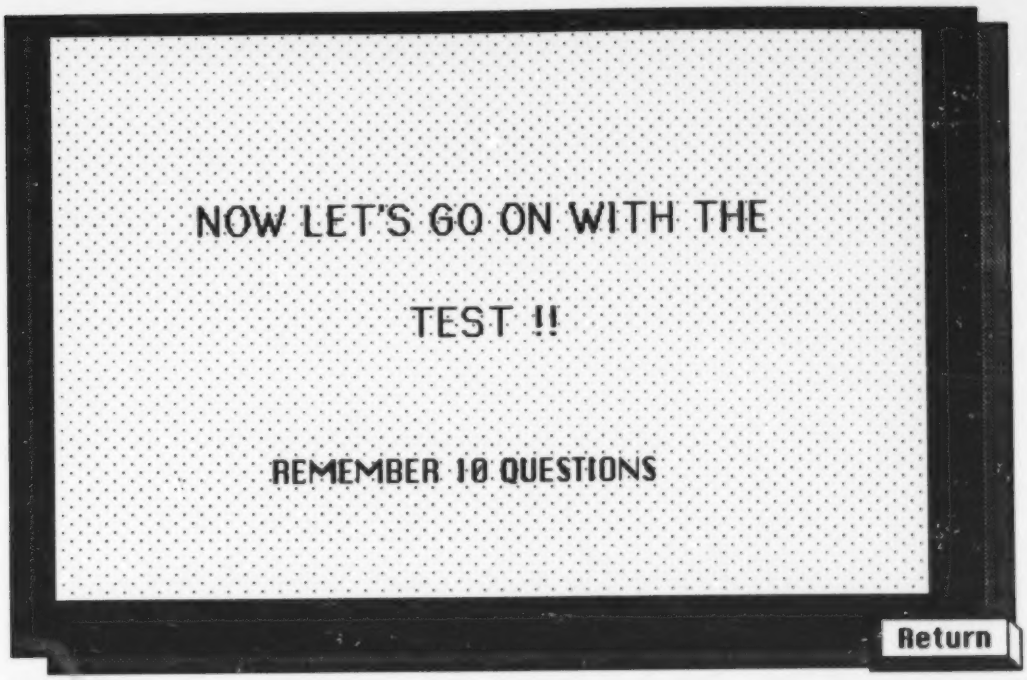
use the mouse and point to the answer you have selected and click the mouse button.

Return

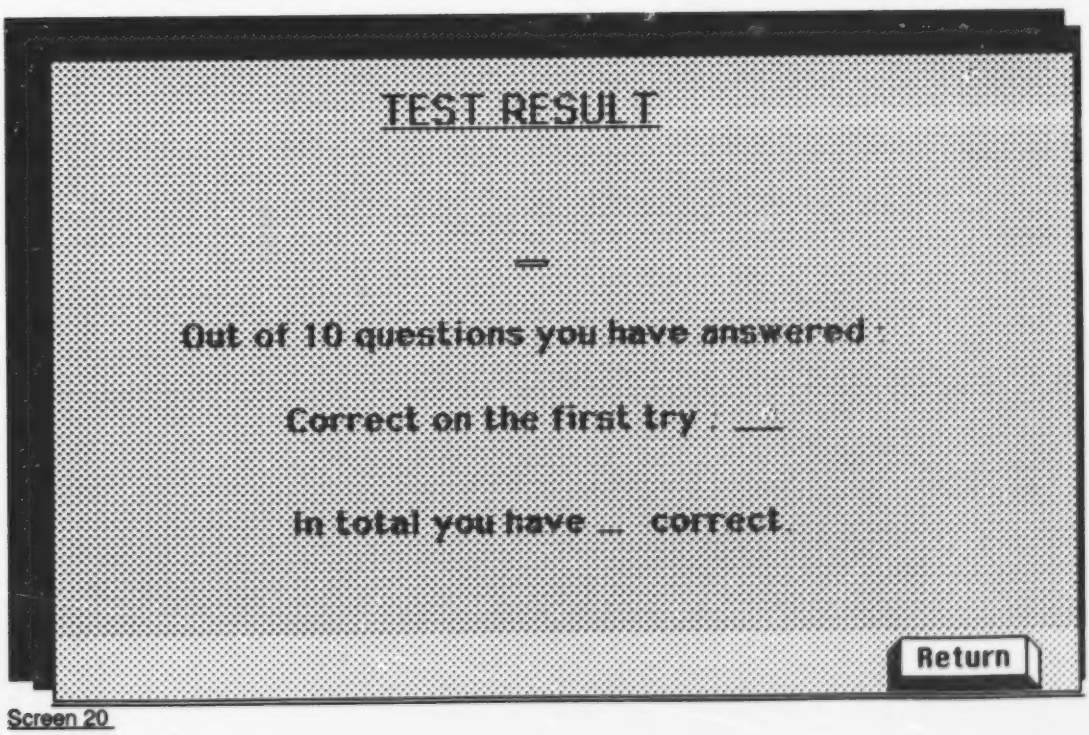
Screen 17



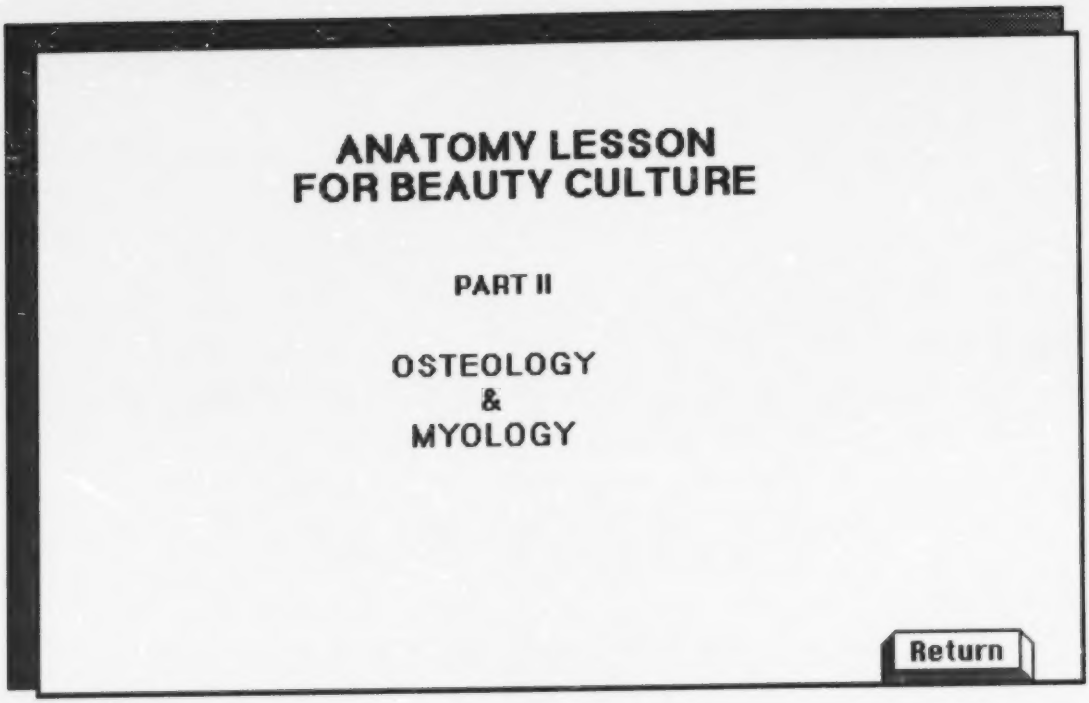
Screen 18



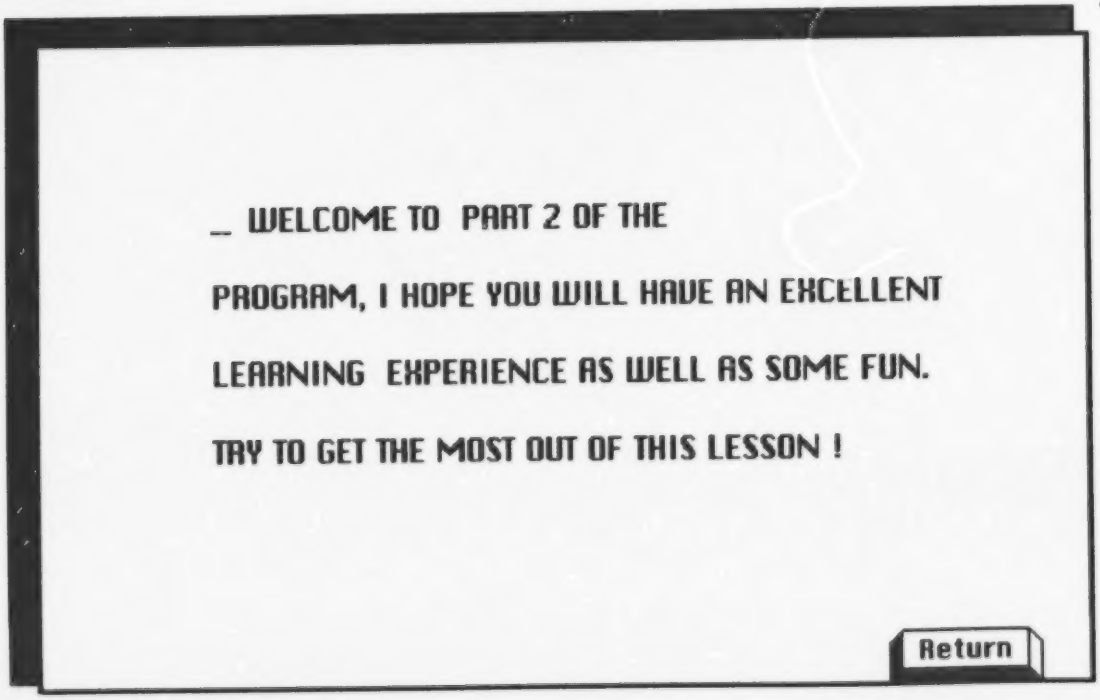
Screen 19



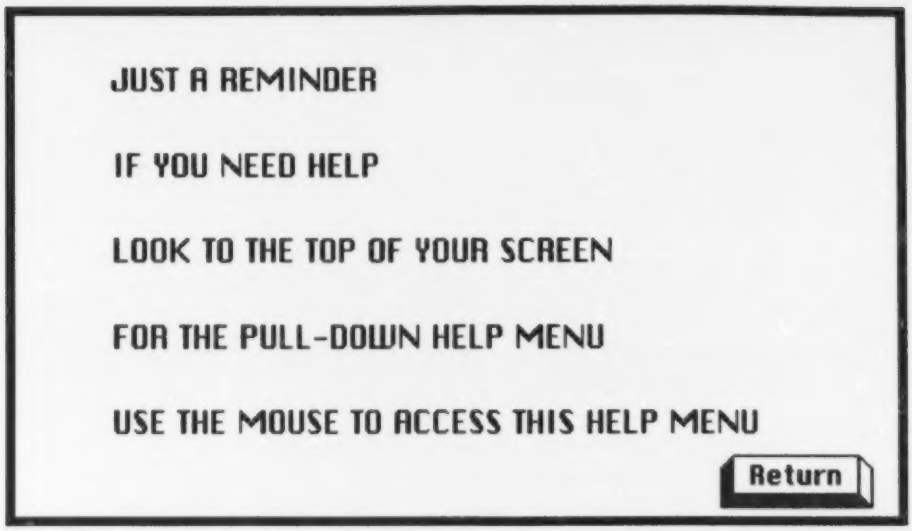
Screen 20



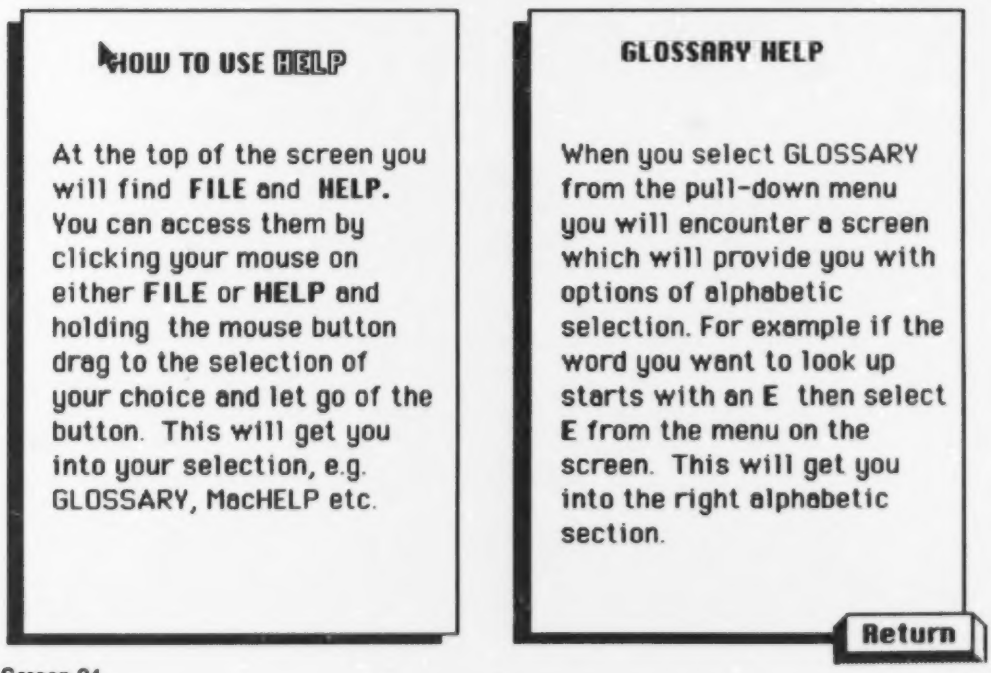
Screen 21


_ WELCOME TO PART 2 OF THE
PROGRAM, I HOPE YOU WILL HAVE AN EXCELLENT
LEARNING EXPERIENCE AS WELL AS SOME FUN.
TRY TO GET THE MOST OUT OF THIS LESSON !
Return

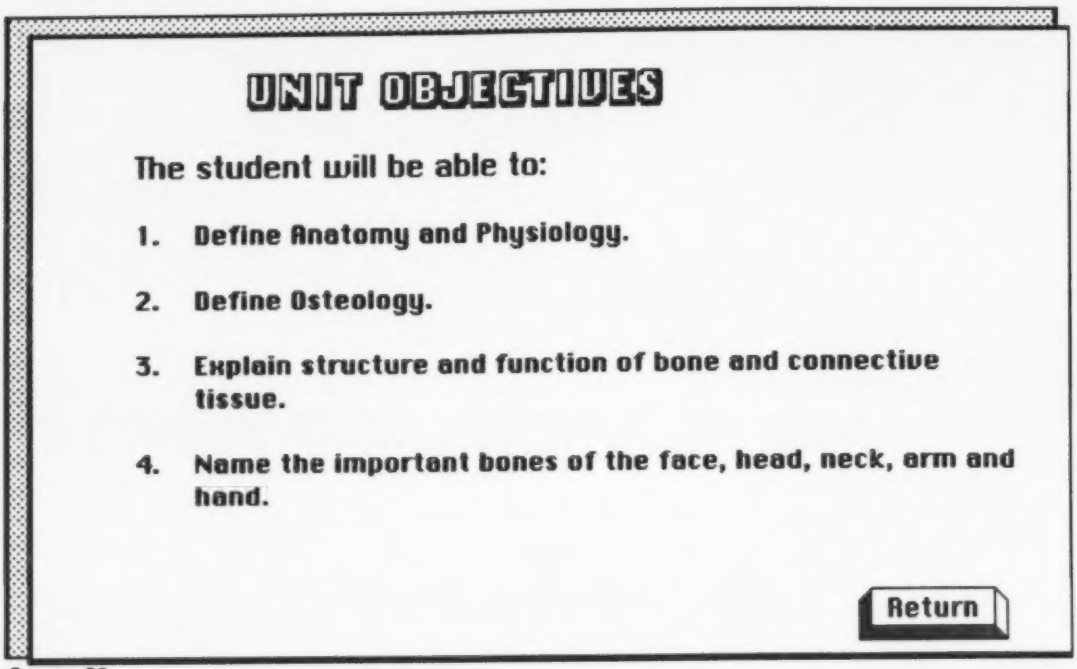
Screen 22


JUST A REMINDER
IF YOU NEED HELP
LOOK TO THE TOP OF YOUR SCREEN
FOR THE PULL-DOWN HELP MENU
USE THE MOUSE TO ACCESS THIS HELP MENU
Return

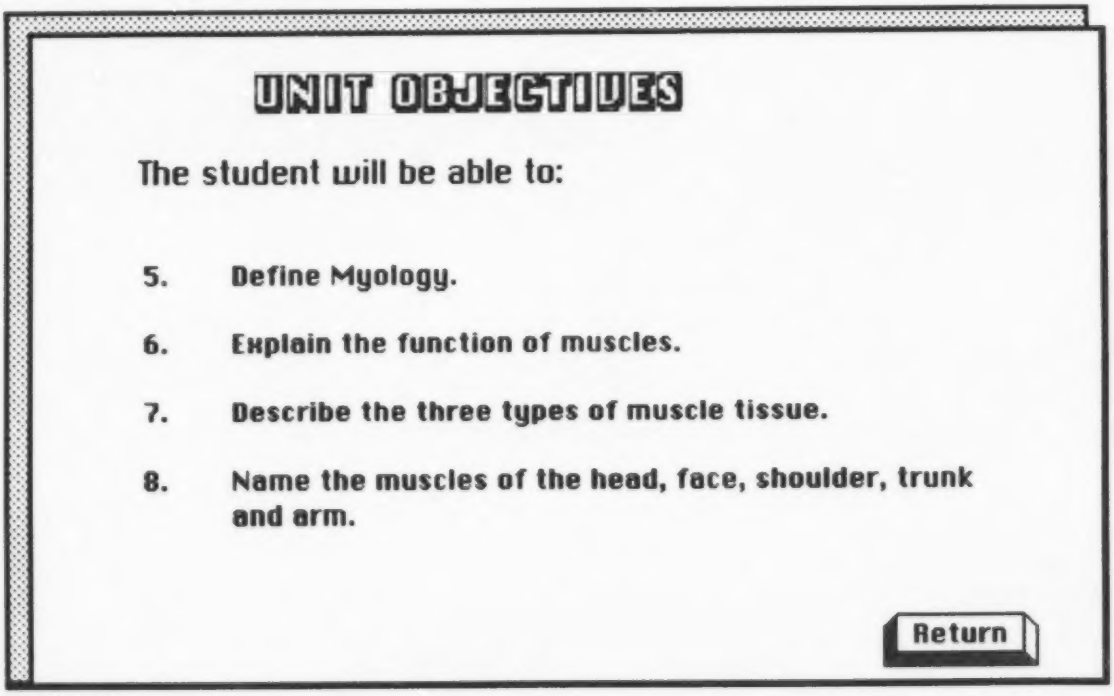
Screen 23


HOW TO USE HELP
At the top of the screen you will find FILE and HELP. You can access them by clicking your mouse on either FILE or HELP and holding the mouse button drag to the selection of your choice and let go of the button. This will get you into your selection, e.g. GLOSSARY, MacHELP etc.
GLOSSARY HELP
When you select GLOSSARY from the pull-down menu you will encounter a screen which will provide you with options of alphabetic selection. For example if the word you want to look up starts with an E then select E from the menu on the screen. This will get you into the right alphabetic section.
Return

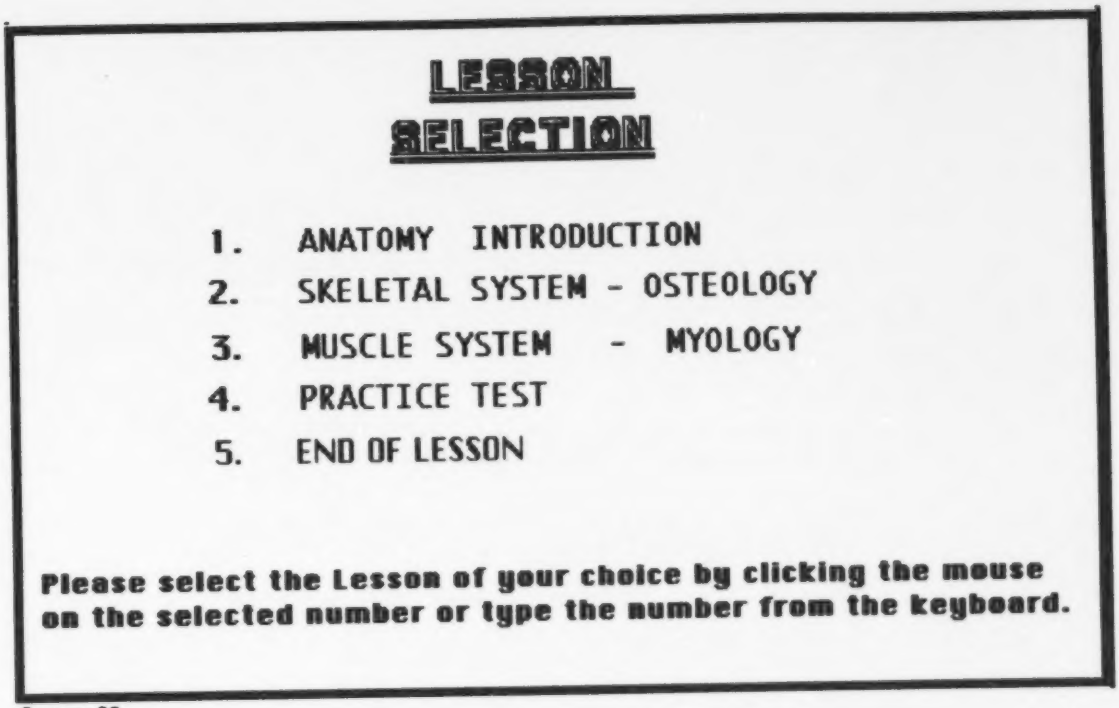
Screen 24


UNIT OBJECTIVES
The student will be able to:
1. Define Anatomy and Physiology.
2. Define Osteology.
3. Explain structure and function of bone and connective tissue.
4. Name the important bones of the face, head, neck, arm and hand.
Return

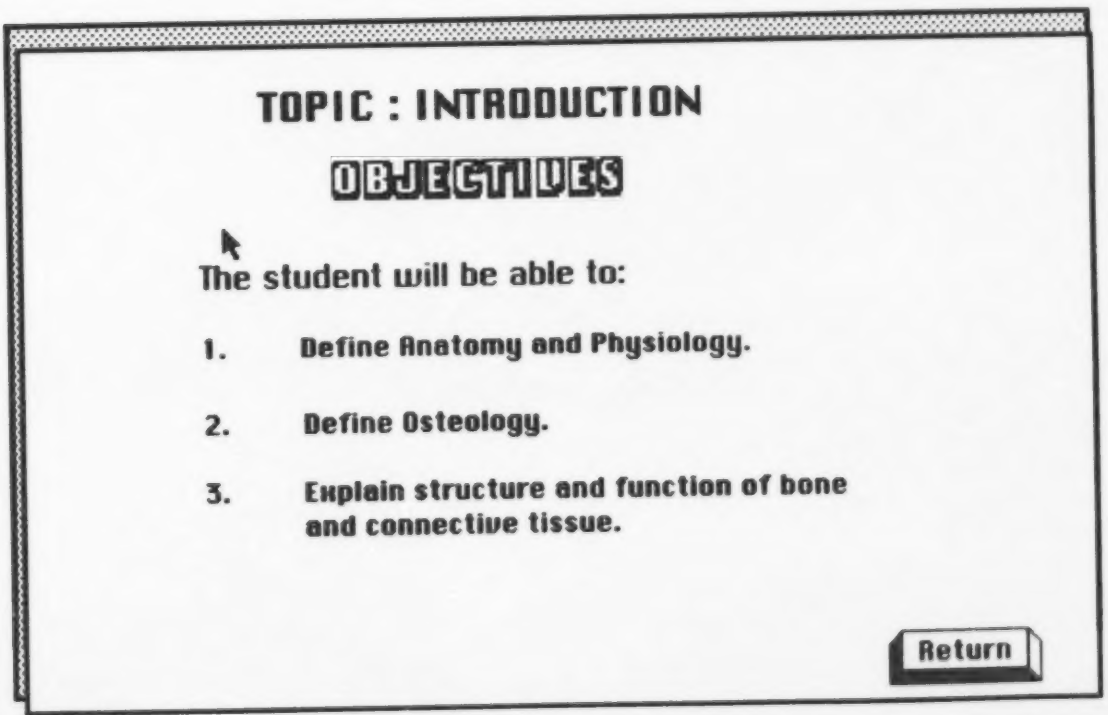
Screen 25


UNIT OBJECTIVES
The student will be able to:
5. Define Myology.
6. Explain the function of muscles.
7. Describe the three types of muscle tissue.
8. Name the muscles of the head, face, shoulder, trunk and arm.
Return

Screen 26


LESSON
SELECTION
1. ANATOMY INTRODUCTION
2. SKELETAL SYSTEM - OSTEOLOGY
3. MUSCLE SYSTEM - MYOLOGY
4. PRACTICE TEST
5. END OF LESSON
Please select the Lesson of your choice by clicking the mouse on the selected number or type the number from the keyboard.

Screen 25


TOPIC : INTRODUCTION
OBJECTIVES
The student will be able to:
1. Define Anatomy and Physiology.
2. Define Osteology.
3. Explain structure and function of bone and connective tissue.
Return

Screen 26

THE HUMAN SKELETAL SYSTEM

The study of the bone structure is called *OSTEOLOGY.*

The bones of the body are referred to as the *SKELETAL SYSTEM.*

The skeletal system provides the physical foundation for the human body.

Return

Screen 27

THE HUMAN SKELETAL SYSTEM

This intricate structure of bones give strength and solidity to the body.
Imagine if your bones made out of jelly, would you be able to hold yourself upright?

YES NO

Screen 28

The two major divisions in the study of the human body are:

ANATOMY

This study is concerned with the *physical structure* of the body. This includes all organs and body systems such as; bones, muscles, nerves and circulation.

PHYSIOLOGY

Physiology investigates the *function* of the body. It examines how all the systems and organs work together to sustain life and function of the human body.

Return

Screen 31

Please answer the question by typing in your answer either in sentence or point form. Use the space in the boxed area for your answer.

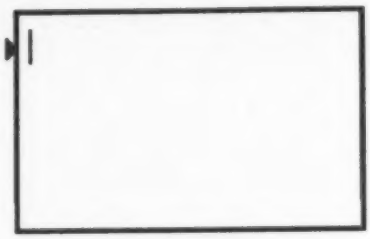
Define *ANATOMY* and give at least three examples of systems involved:

Please press the RETURN key when done.

Screen 32

Give an explanation of ; what is *PHYSIOLOGY* :

Use the space below to type in your answer much like the previous question.



BONES

All the bones in the human body as a group are referred to as the skeletal system.

Bone is made up of a firm hard tissue composed of one third organic matter and two third mineral matter.

Bone is living tissue even though it contains non-living matter.

Return

FUNCTION OF BONES

- Provide strength to the human body
- Give the body shape
- Protect all internal organs from injury
- Serve as attachment for muscles
- Provide levers for body movements

Return

Screen 33

COMPOSITION OF BONE

Bone is made up of *cancellous* and *compact* tissue.

CANCELLOUS: This is a tissue which is slightly spongy.

It is located at the end of long bones such as legs and arms.

Another place where this spongy type of bone is found is the inside of flat bones such as the skull.

Return

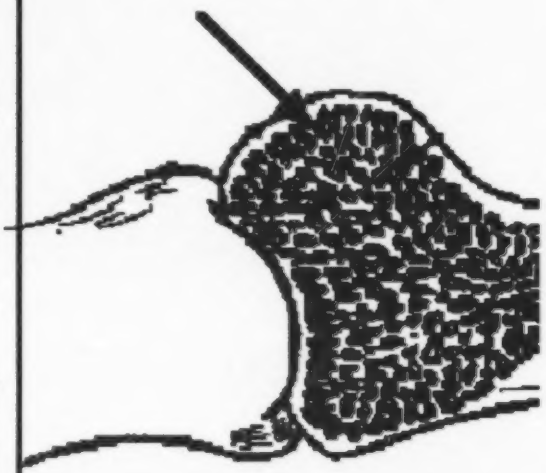
Screen 34

CANCELLOUS TISSUE

What you see on the screen is an example of bone containing cancellous tissue.

Note: The spongy appearance.

The picture demonstrates the cancellous tissue at the end of long bone joined to another.



Return

Screen 35

COMPACT : **This tissue is the dense or, hard bone tissue. The shafts of the long bones (legs & arms) are made with this dense bone tissue and also the outside of flat bones (skull).**

This bone tissue contains small channels , known as *HAVERSIAN CANALS*

These haversian canals contain very small blood vessels.

Return

Screen 36

BONE MARROW

Bone marrow is a fatty substance contained in bone cavities, but only certain bones in adults have blood producing red bone marrow.

The marrow inside some bones produce red blood cells carrying oxygen and nutrients throughout the human body.

The marrow in other bones make millions of white blood cells which are capable of destroying harmful bacteria.

These white blood cells help the body fight infection.

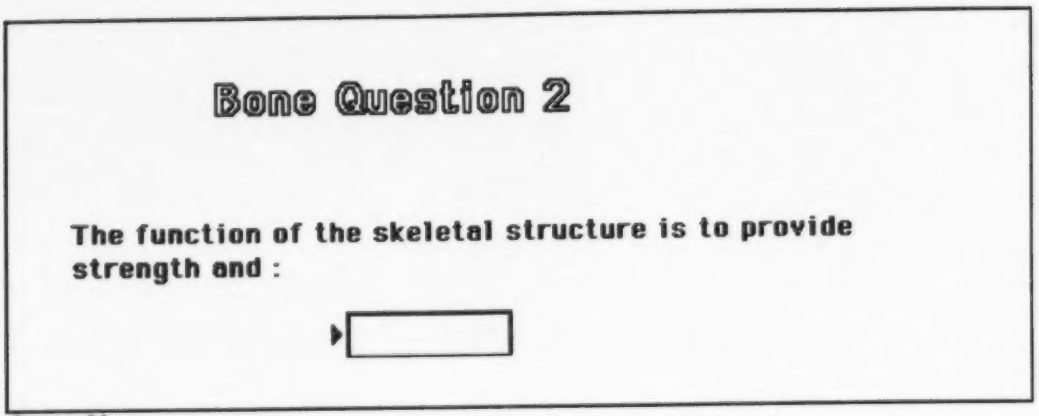
Return

Screen 37

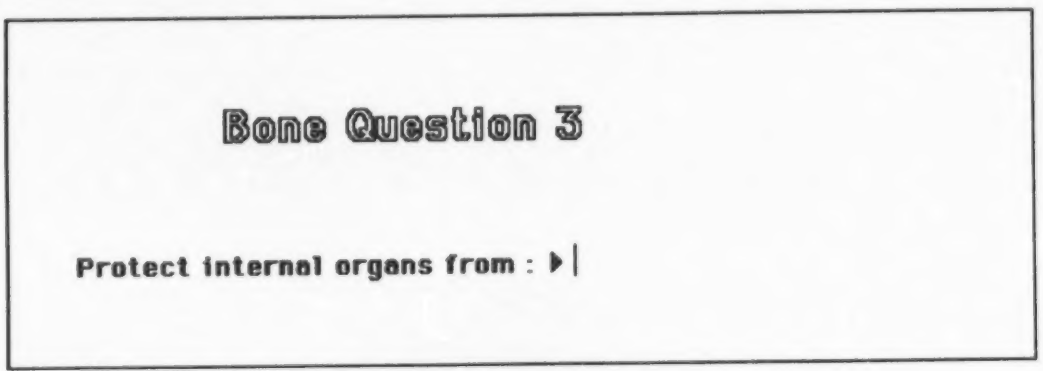
Bone Question 1

What is the technical term describing the scientific study of bones?

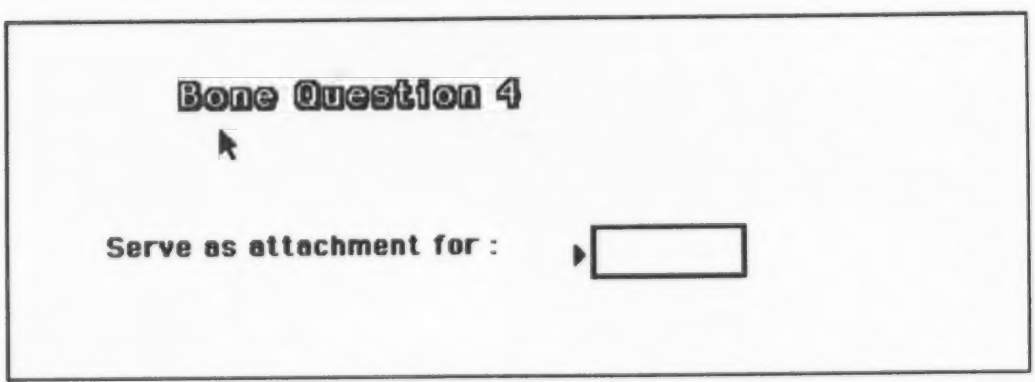
Screen 38



Screen 39



Screen 40



Screen 41

BONE JOINTS

Bone joints are the places where two or more bones meet.

There are different types of joints and they are:

- movable joints as in fingers and toes
- immovable - example would be the cranium
- slightly movable joints much like the spine

Return

Screen 42

TYPE OF BONE JOINT

Pivot Joint

A good example of a pivot joint is the neck, it turns with a rotating motion.

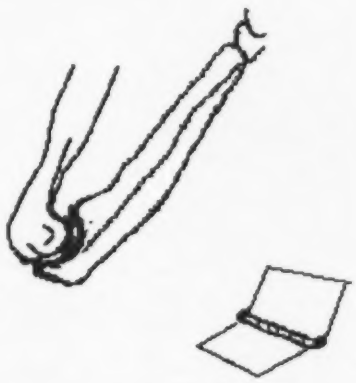
Example of pivoting the head.

Return

Screen 43

HINGE JOINT

An example of this joint is the elbow or wrist. At the elbow, the radius and the ulna form a hinge joint with the humerus bone



Example of Elbow Hinge Joint

Return

Screen 46

SELF REPAIR

Bones have the ability to repair themselves without leaving scars.

The ability of selfrepair is evident in broken bone which mend and heal and perfom normal, or near to normal after the healing process is complete.

Return

Screen 47

PERIOSTEUM

The periosteum is latin for "**surrounding the bone**", it is a fibrous membrane which covers the bone. It serves to protect the bone.

The periosteum which surrounds compact bone contains nerves and when injured carries messages of pain to the brain.

When bone is injured nerve fibres contained in the passage ways of bone send distress signals to the periosteum which in turn relies the pain message to the pain center in the brain.

Return

Screen 48

QUICK SUMMARY:

PERIOSTEUM, COMPACT BONE AND BONE MARROW WORK TOGETHER AS A TEAM.

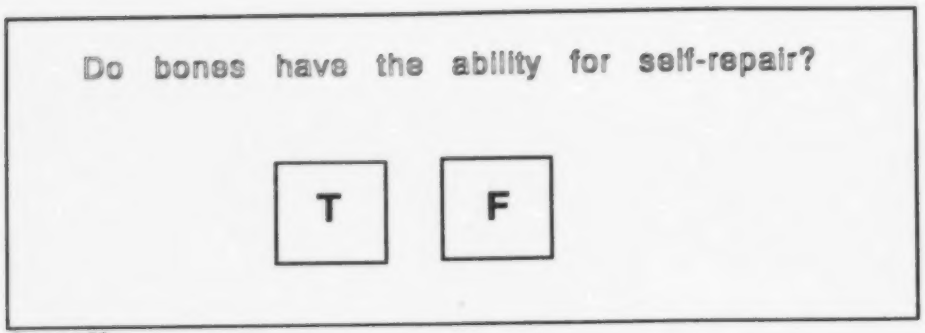
THEY INTERACT WITH ONE ANOTHER SENDING NERVE MESSAGES BACK AND FORTH.

BLOOD FLOWS BETWEEN THESE LAYERS.

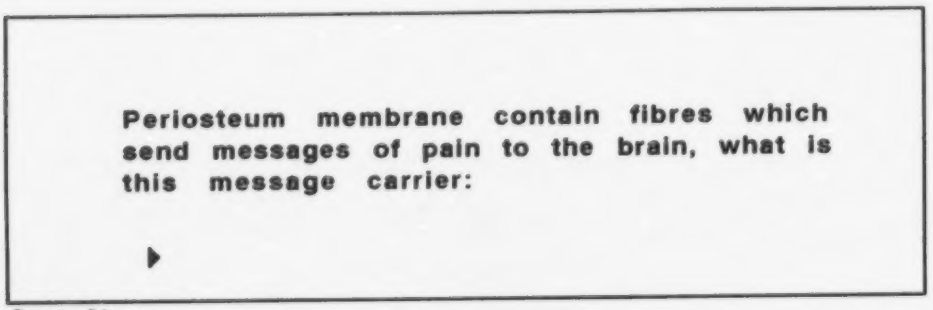
WE TEND TO THINK OF BONE BEING DEAD, BUT FAR FROM IT, THERE IS MUCH ACTIVITY WITHIN THE BONES OF THE HUMAN BODY.

Return

Screen 49



Screen 50



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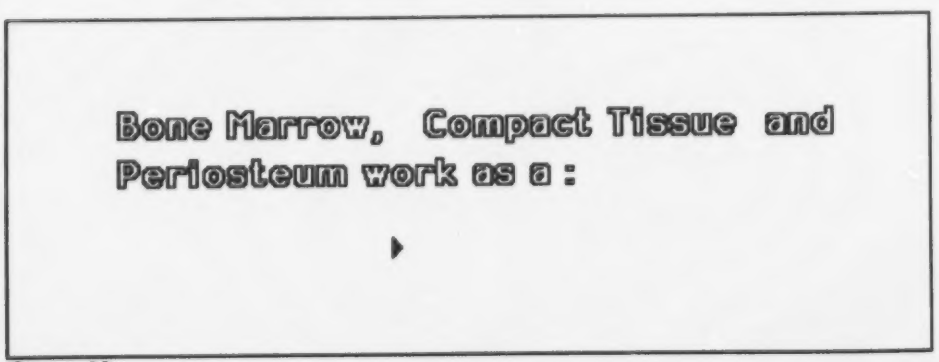


Screen 52

CARTILAGE

CARTILAGE is a tough, dense elastic substance.

Cartilage is a supporting tissue containing no minerals.

It gives shape to certain features of the human body such as your nose, ears and is the main support for the larynx.

Return

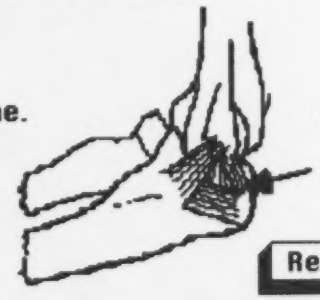
Screen 53

LIGAMENTS

Ligaments are connective tissues which are very strong and stretch very little.

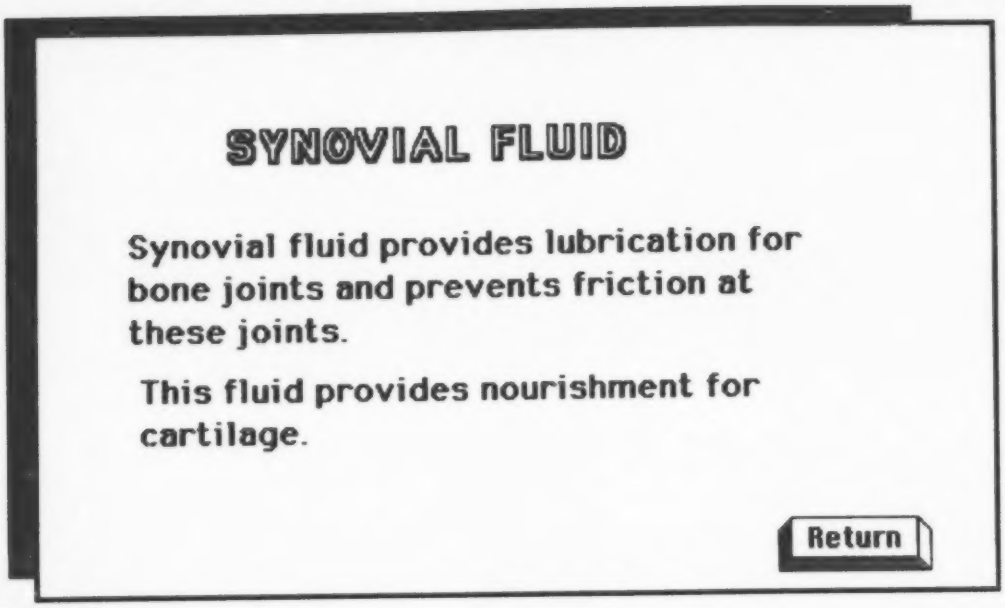
It is seen as bands of fibrous tissue giving support to bones at joints such as; wrist and ankles.

Ligaments connect bone to bone.

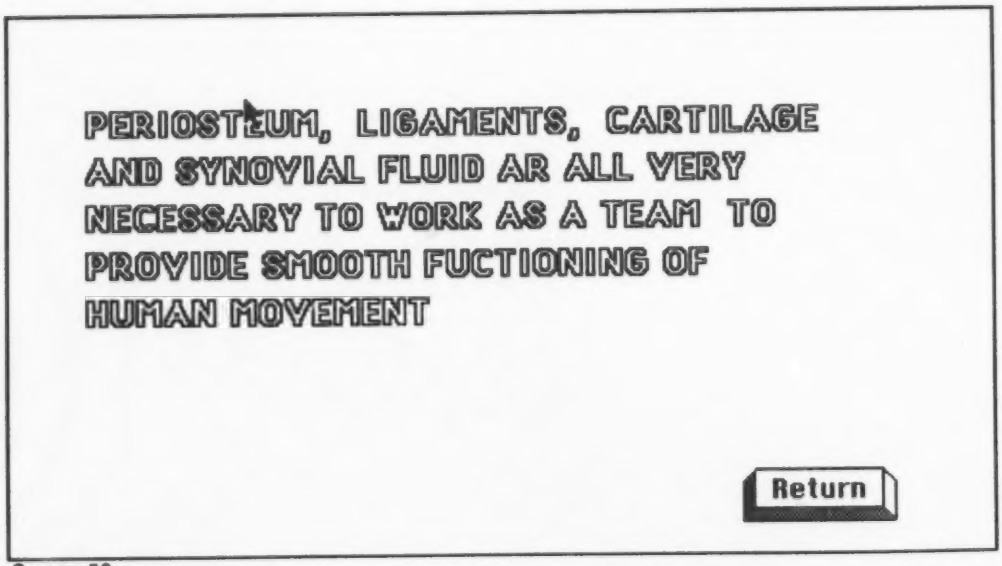


Return

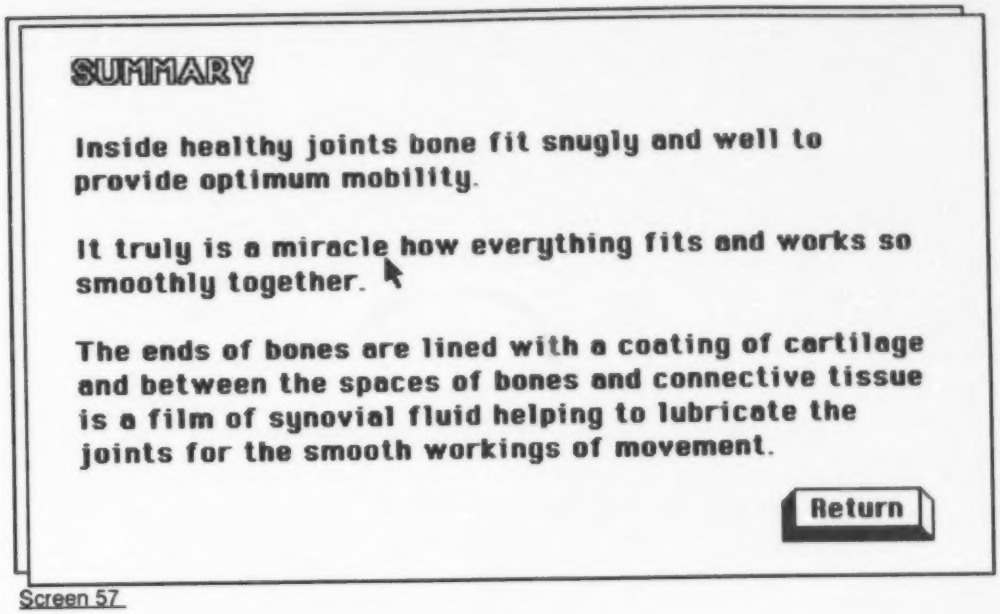
Screen 54


SYNOVIAL FLUID
Synovial fluid provides lubrication for bone joints and prevents friction at these joints.
This fluid provides nourishment for cartilage.
Return

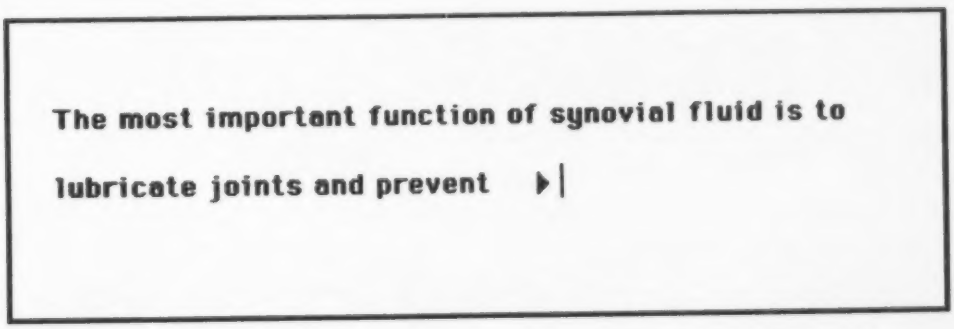
Screen 55


PERIOSTEUM, LIGAMENTS, CARTILAGE AND SYNOVIAL FLUID AR ALL VERY NECESSARY TO WORK AS A TEAM TO PROVIDE SMOOTH FUCTIONING OF HUMAN MOVEMENT
Return

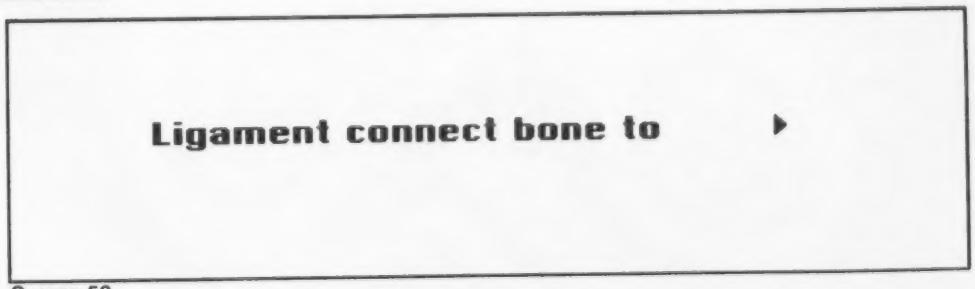
Screen 56


SUMMARY
Inside healthy joints bone fit snugly and well to provide optimum mobility.
It truly is a miracle how everything fits and works so smoothly together.
The ends of bones are lined with a coating of cartilage and between the spaces of bones and connective tissue is a film of synovial fluid helping to lubricate the joints for the smooth workings of movement.
Return

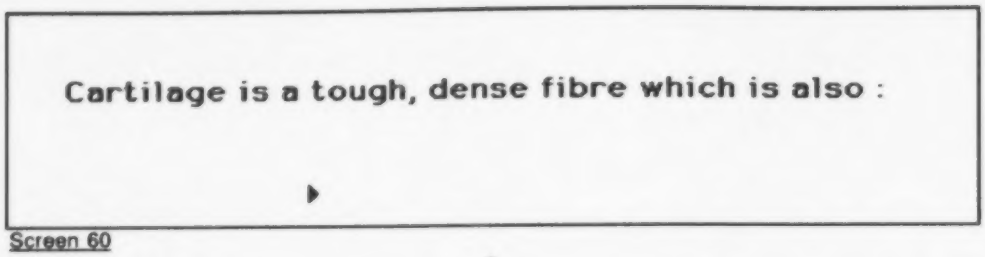
Screen 57



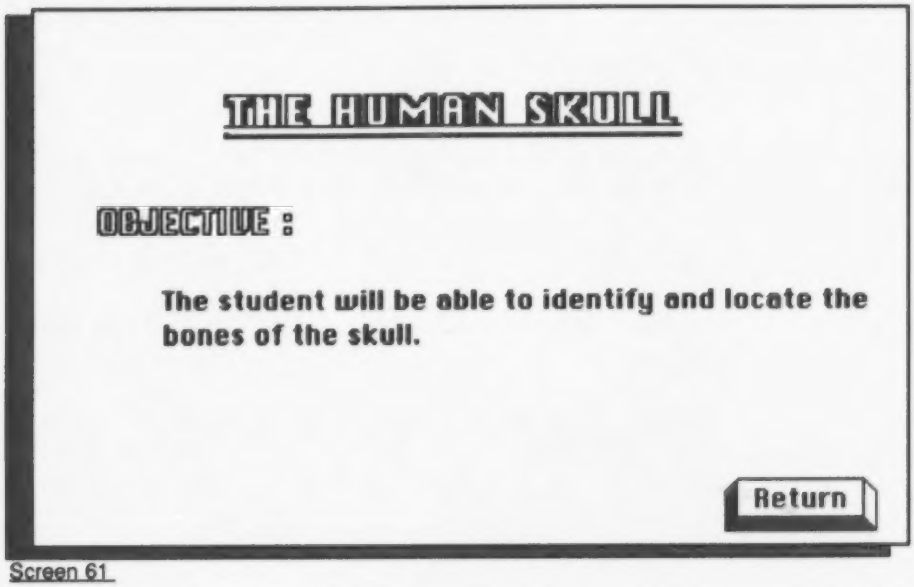
Screen 58



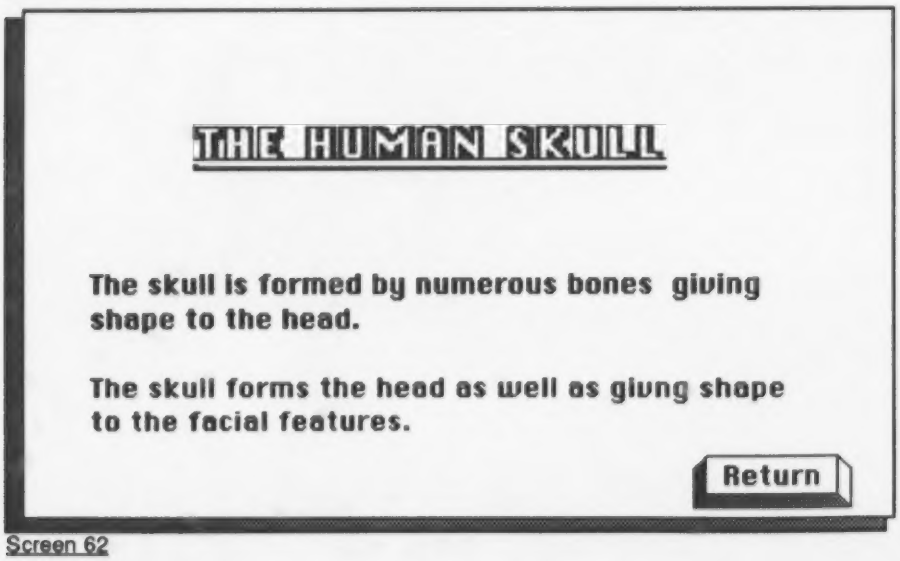
Screen 59



Screen 60



Screen 61

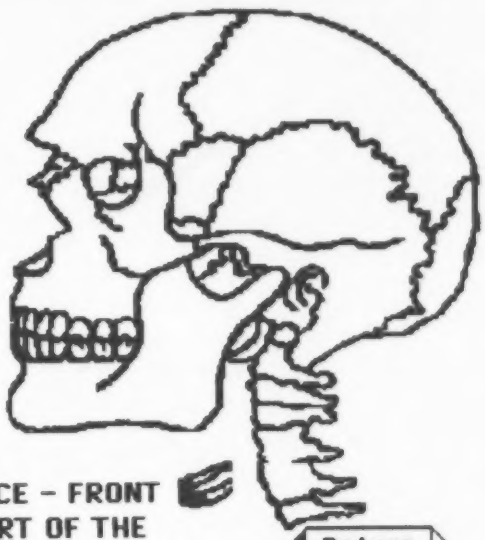

THE HUMAN SKULL
The skull is formed by numerous bones giving shape to the head.
The skull forms the head as well as giving shape to the facial features.
Return

Screen 62

THE SKULL BONES

The skeleton of the head is an oval shaped, bony case protecting the brain. It also gives shape and structure to the human head. The CRANIUM is the bony structure protecting the brain.
The facial bones are not part of the CRANIUM. But CRANIUM and FACIAL bones are part of the skull structure

CRANIUM - UPPER AND TOP PART OF THE HEAD. 1



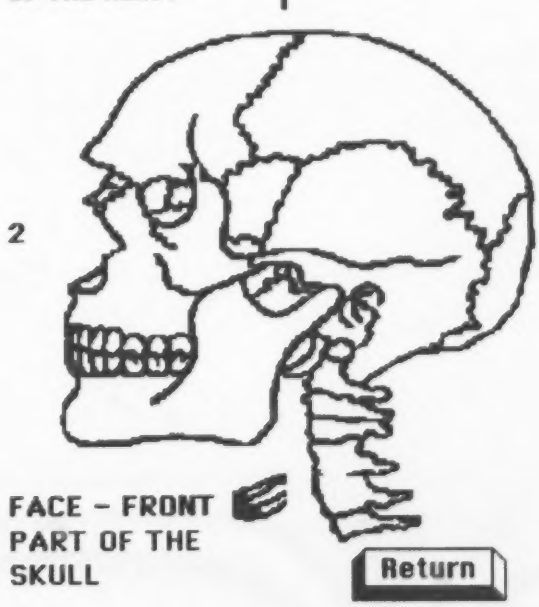
Screen 63

THE SKULL BONES

Two parts of the skull are:

1. CRANIUM - is made up of 8 bones.
2. SKELETON OF THE FACE- there are 14 facial bones

CRANIUM - UPPER AND TOP PART OF THE HEAD. 1



Screen 64

OBJECTIVE

The student will be able to name and locate the fourteen bones of the face.

Return

Screen 65

FACIAL BONES

The skeleton of the face is made up of 14 *Facial Bones*.

1. **LACRIMAL,** there are two Lacrimal bones located at the front part at the inside wall of the eye cavity. They are the smallest and most fragile bones of the facial skeleton.
   The tear duct canals are located here.

1

Return

Screen 66

14 BONES OF THE FACIAL SKELETON

2. **NASAL,** two nasal bones are located side by side in the upper middle portion of the face. These bones form the bridge of the nose.

3. **Two Zygomatic** (also known as Malar bones) located in the outer and upper part of the facial structure. They form the prominate cheeks and are also part of the temporal area.

These facial structures are important when cutting and styling hair and are important when giving facials.

Return

Screen 67

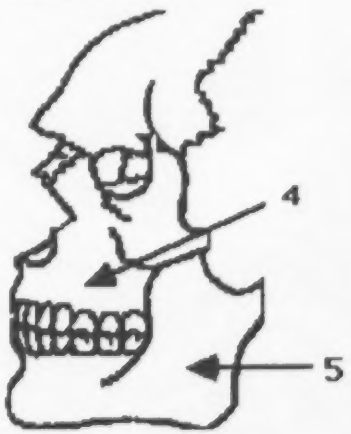
14 BONES OF THE FACIAL SKELETON

4. **Maxillae,** two Maxillae bones are the largest facial bones and form upper jaw.

Important when giving facials and applying make-up.

5. **Mandible** Bone forms the lower jaw and is the largest and strongest bone of the face. They also accomodate the lower teeth

Again important in facial massage and make-up application.



Return

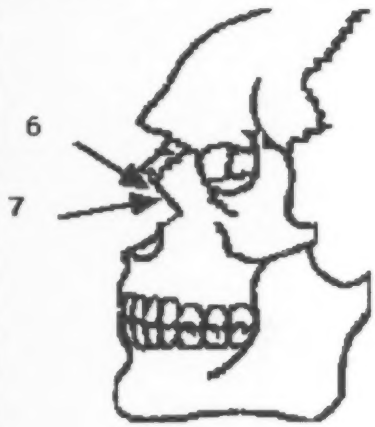
Screen 68

14 FACIAL BONES

6. **Two Palatine bones** are located at the back of the nasal cavity, providing a floor and outer wall for the nose the roof of the mouth and the bottom of the eye orbits.

7. **Vomer,** one bone at the back of the nasal cavity forming part of the dividing wall for the nose

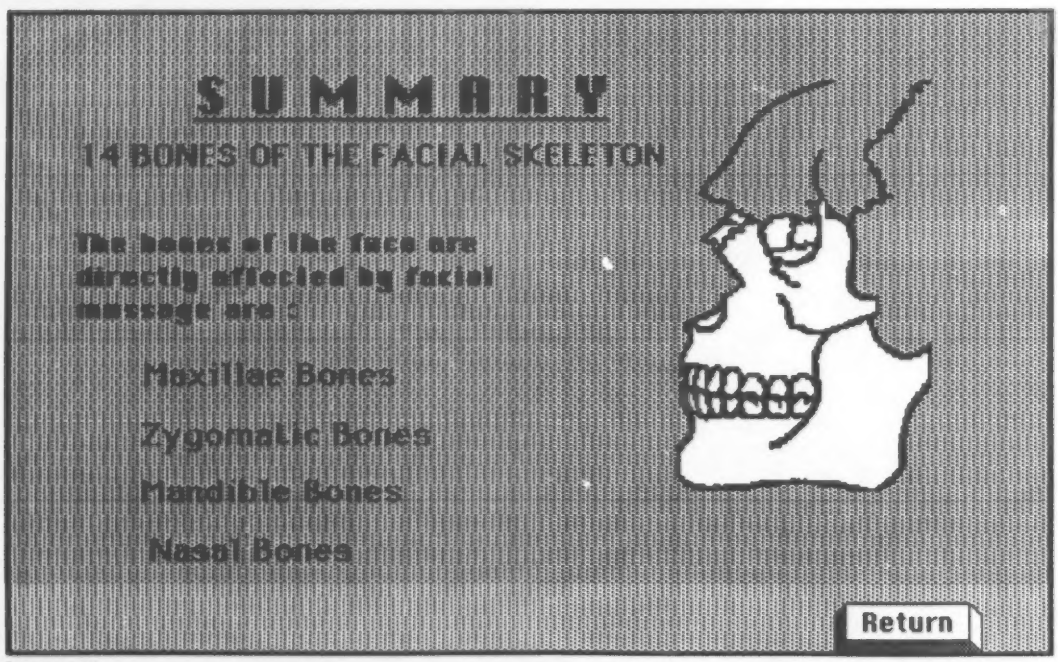
These bone structures are an important part of the face and are directly and indirectly involved in any facial manipulations.



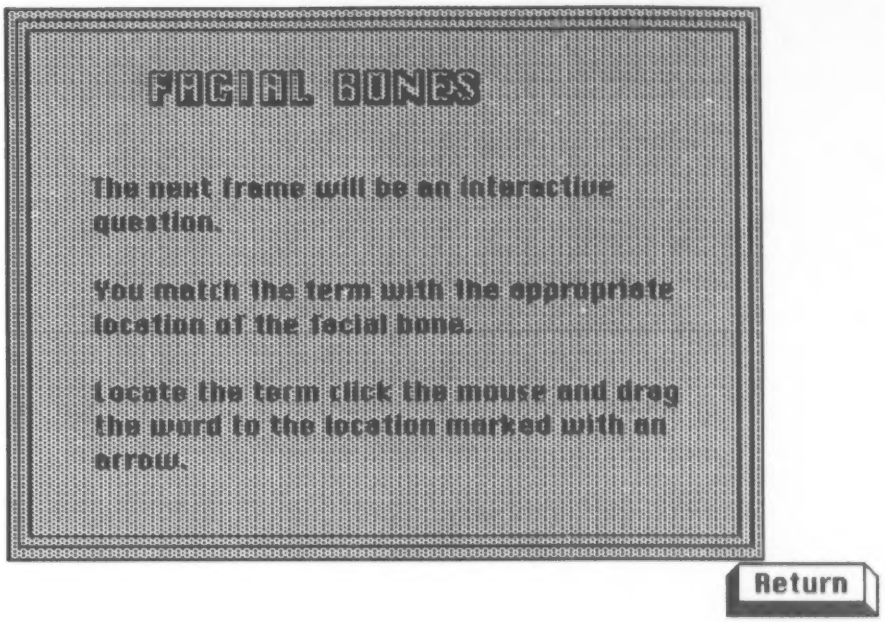
6 & 7 are not visible from the ouside they are an interior part of the structure.

Return

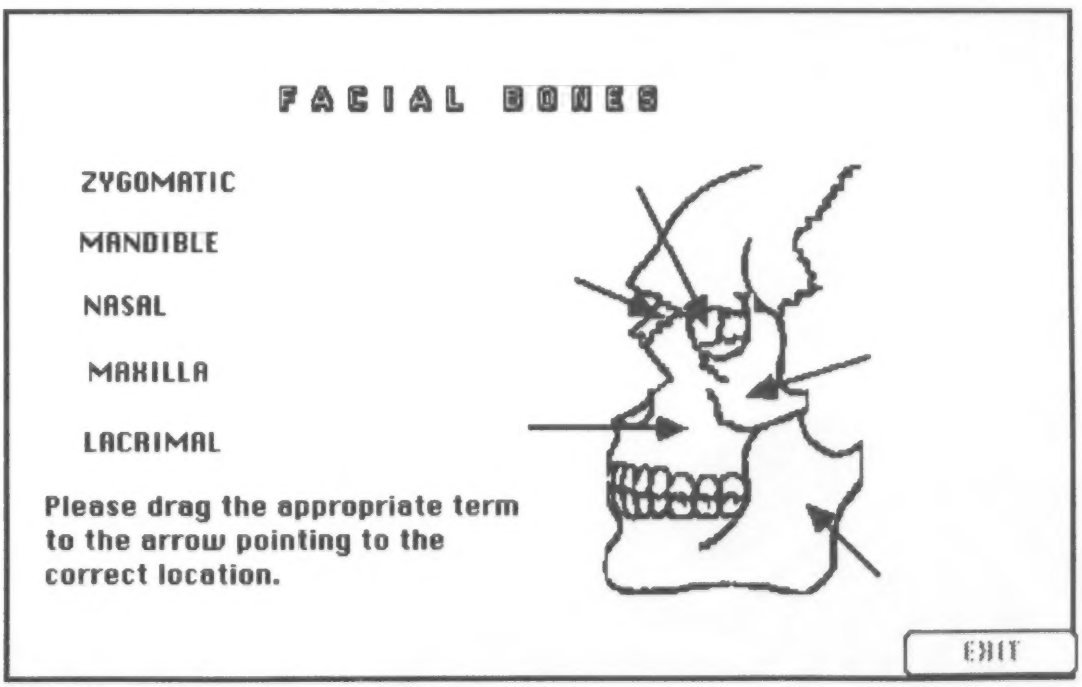
Screen 69



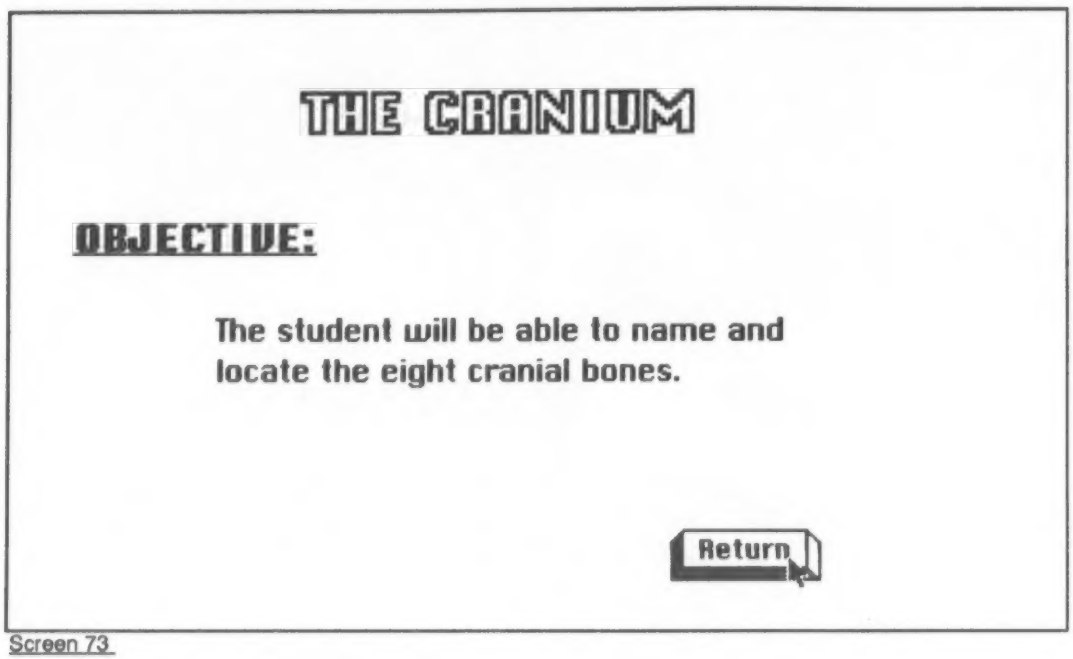
Screen 70


FACIAL BONES
The next frame will be an interactive question.
You match the term with the appropriate location of the facial bone.
Locate the term click the mouse and drag the word to the location marked with an arrow.
Return

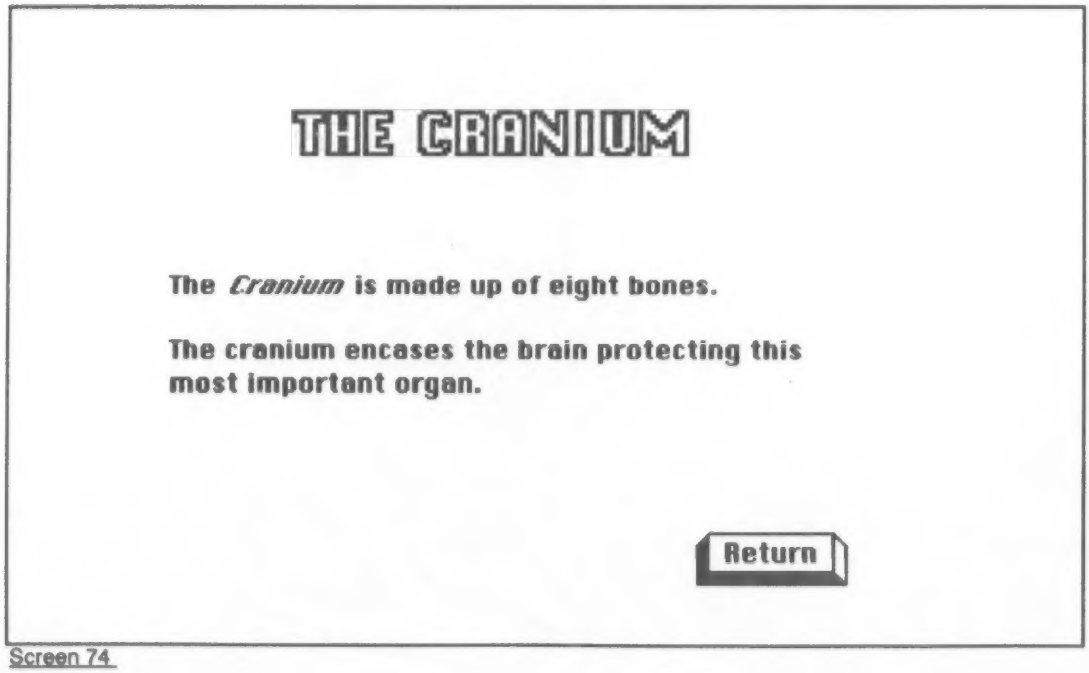
Screen 71



Screen 72



Screen 73


THE CRANIUM
The *Cranium* is made up of eight bones.
The cranium encases the brain protecting this most important organ.
Return

Screen 74

8 BONES OF THE EPICRANIUM

1. OCCIPITAL - back of the cranium.

Frequently referred to when cutting hair.

Return

Screen 75

8 BONES OF THE EPICRANIUM

2. **PARIETAL,** two bones form the sides and the crown of the cranium

This part of the head is important because often clients have problems with cowlicks and "double crowns" which cause hair to either lie flat or stick straight up. The operator has to be cautious when cutting hair or curling the hair in this area.

Return

Screen 76

8 BONES OF THE EPICRANIUM

3. **The Frontal bone** is devided into two parts:
   a) the part which forms the forehead and
   b) the portion forming the orbits for the eyes as well as the depression for the nose.

This part of the cranium plays an important role in scalp and facial massages as well as in providing a guide for cutting the hair at the facial periphery.

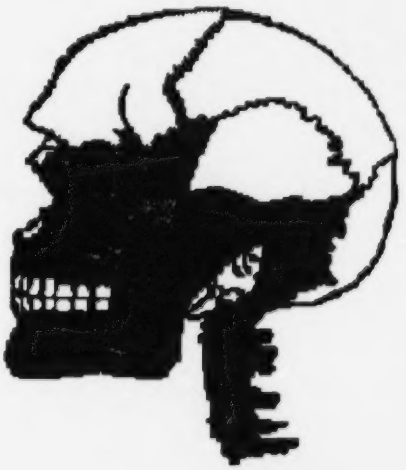
Return

Screen 77

8 BONES OF THE EPICRANIUM

4. **Two Temporal bones** one on either side of the skull in the ear region just below the Parietal bones.

This area is also an important consideration during hair cutting and scalp and facial massages.



Return

Screen 78

8 BONES OF THE CRANIUM

5. **Ethmoid bone**, small, light spongy type of bone located between the eye orbits at the base of the nose dividing it in half.

Return

Screen 79

8 BONES OF THE CRANIUM

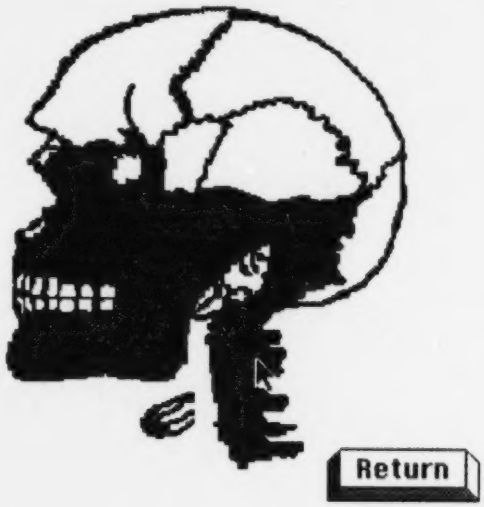
6. **Sphenoid bone** located at the back of the eye orbits and the base of the cranium, it joins together all the bones of the cranium.

Return

Screen 80

8 BONES OF THE EPICRANIUM

The **HYOID** bone is part of the neck, it is a U-shaped bone in front of the throat. Often called the "Adam's Apple" It supports the tongue

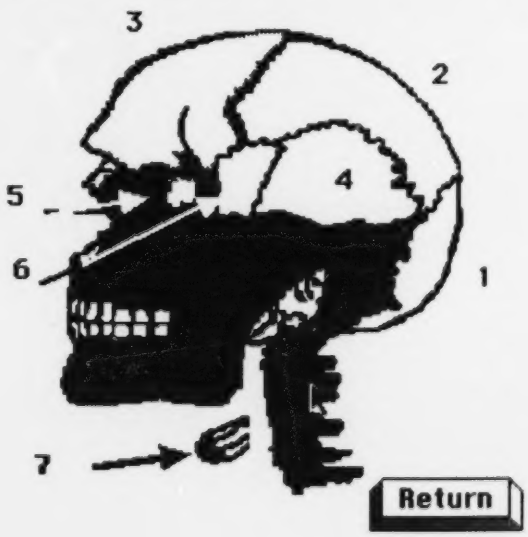


Screen 81

SUMMARY

8 BONES OF THE EPICRANIUM

1. OCCIPITALIS
2. 2 PARIETAL BONES
3. FRONTALIS
4. 2 TEMPORAL BONES
5. ETMOID BONE
6. SPHENOID BONE
7. HYOID BONE



Screen 82

BONES OF THE HEAD DISPLAY

The next objective is to point to the correct place on the graphic display.

Double click the mouse when selecting the correct spot matching the term.

Return

Screen 83

BONES OF THE HEAD

Locate the Occipitalis Bone and click on it.

NOTE: remember to *Double Click*!!!

BONES OF THE HEAD

Locate the Ethmoid Bone and click on it.

Hint... this bone is a little difficult to find.

Yes, that is the correct location.

NOTE: remember to *Double Click*!!!

Return

Screen 85

OBJECTIVE

Name the important bones of the arm and hand.

Return

Screen 86

BONES OF SHOULDER, ARM AND HAND

It is important for the COSMETOLOGIST to understand the function and structure of human body parts.

Return

Screen 87

Why Do You have To Know All This Anatomy?

The operator/hairstylist must understand the processes of the various services and problems which may be encountered when giving manicures, facials and other services.

Return

Screen 88

Intro. cont...

An understanding of the structure of nails, hands and arms is essential in explaining to the manicurist why certain procedures have to be observed when giving a manicure, hand and arm massage.

Return

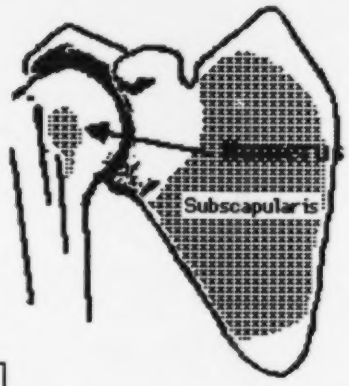
Screen 89

The SCAPULA and CLAVICLE provide a movable platform from which the large bone, called the HUMERUS moves freely.
The HUMERUS is the large bone in the upper arm.

Return

Screen 90

The SCAPULA and CLAVICLE provide a movable platform from which the large bone, called the HUMERUS moves freely.
The HUMERUS is the large bone in the upper arm.



The HUMERUS is joined to the shoulder bone by a ball and socket joint.

Return

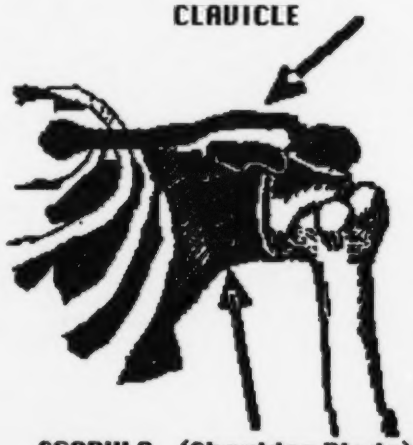
Screen 91

THE BONES OF SHOULDER AND ARM

SHOULDER

The shoulder is made up of the *Clavicle* and the *Scapula*.

Scapula, also called shoulder blades, stand out on the upper back and are held in place by the **clavicle** (collar bone)



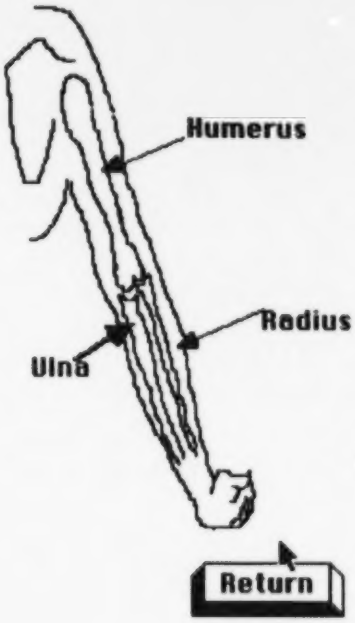
Return

Screen 92

ARM BONES

The important bones in the arm are:

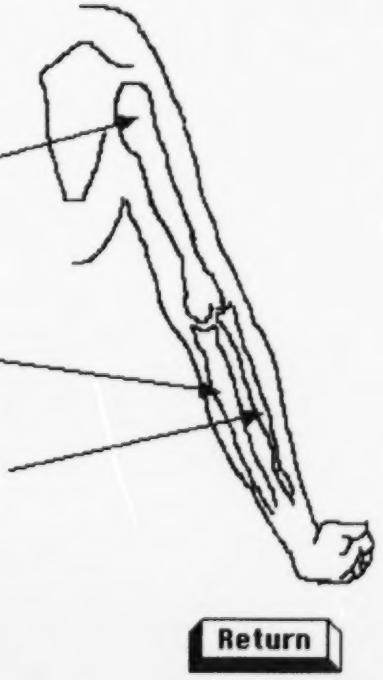
1. Humerus
2. Ulna
3. Radius



Screen 93

ARM BONES

1. HUMERUS - The largest and longest bone of the upper arm.
2. ULNA - Slim bone of the forearm on the "little finger" side.
3. RADIUS - The long forearm bone on the side of the thumb.



Screen 94

ARM QUESTION 1

The long bone of the upper arm is called:

Screen 95

ARM QUESTION 2

The bone located on the little finger side of the forearm is known as :

Screen 96

ARM QUESTION 3

The bone located on the thumb side of the forearm is known as :

Screen 97

ARM QUESTION 4

The shoulder blades are held in place by a bone called the:

Screen 98

QUESTION 5

The palm which is made up of five slender bones is also known by this scientific name:

Screen 99

QUESTION 6

The bones of the three digits on the finger are known as :

Screen 100

QUESTION 7

How many *phalanges* or bones do the finger and the thumb have in total?

Screen 101

MUSCULAR SYSTEM - MYOLOGY

OBJECTIVE :

1. Describe function of muscles
2. Understand muscle contraction
3. Describe Origin and Insertion of muscle

Return

Screen 101

MUSCULAR SYSTEM - MYOLOGY

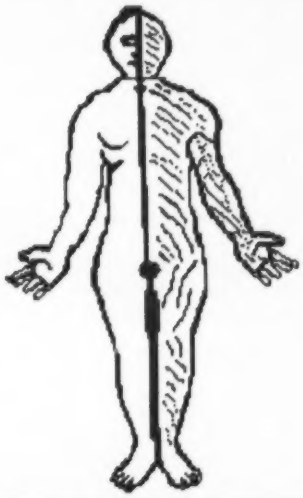
OBJECTIVE :

4. Locate and name facial muscles
5. Locate and name epicranius musles
6. Locate and name the shoulder and arm muscles

Return

Screen 102

MUSCULAR UNIT



Return

Screen 103

MUSCULAR UNIT

MYOLOGY

The scientific study of muscles is called *MYOLOGY*

Without muscles the movement of the human body would be impossible

Return

Screen 104

MUSCULAR UNIT

MYOLOGY

The scientific study of muscles is called *MYOLOGY*

Without muscles the movement of the human body would be impossible

The human body has over 500 large and small muscles which make up 40% to 50% of body weight

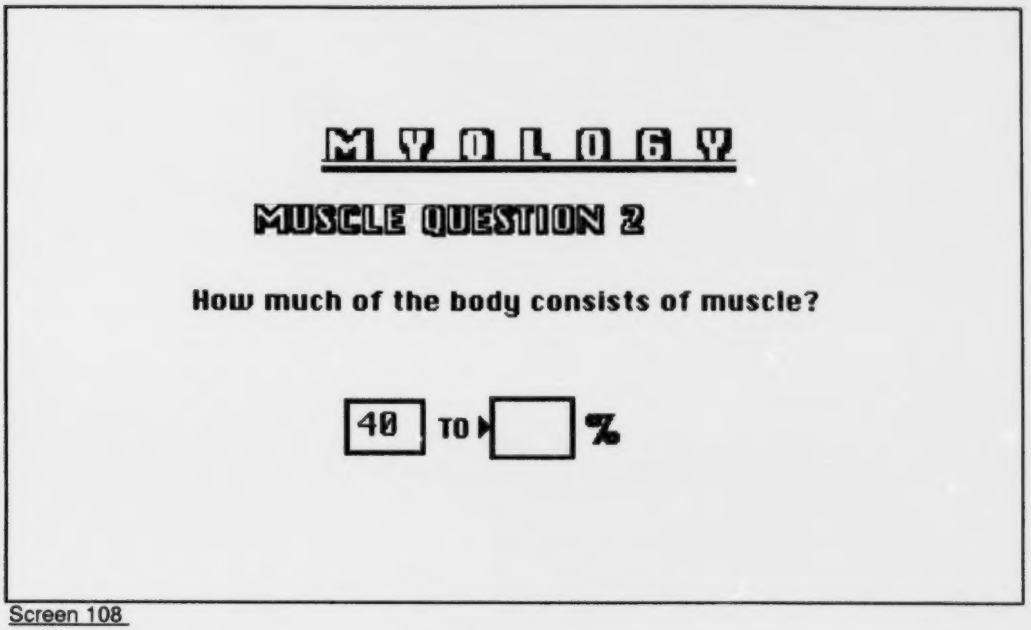
Screen 105

MYOLOGY

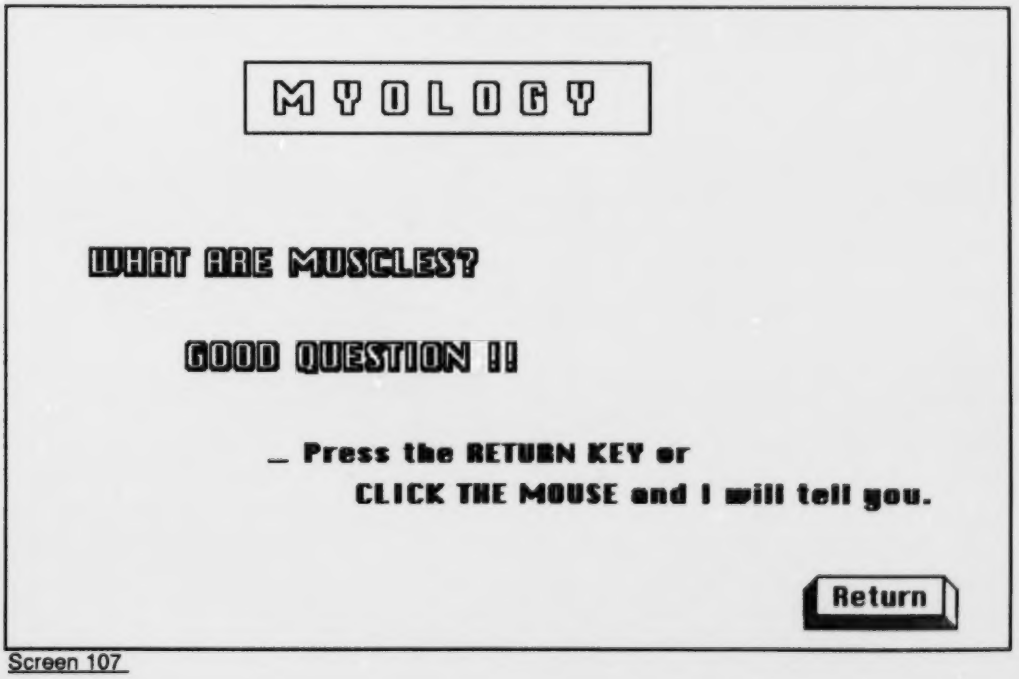
MUSCLE QUESTION 1

Do you remember, approximately how many muscles the human body has?

Screen 106



Screen 108



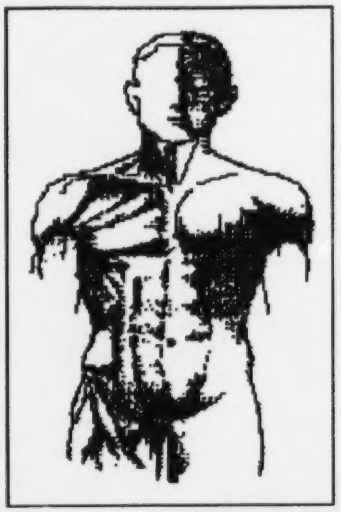
Screen 107

MYOLOGY

Muscle is a strong fibrous tissue which has the ability to contract.

Shape and support of the human skeleton is provided by muscle.

Muscle tissue come in various sizes, length and shapes depending on what function and purpose they serve.



Return

Screen 109

PURPOSE OF MUSCLE

As you remember from one of the previous screens muscle provides the body with the ability to move.

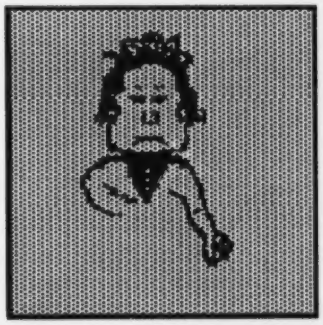
This is achieved when muscle excert pressure on bone which in turn causes movement such as walking and talking.

Screen 110

Purpose cont...

Movement of muscles involves a process of nerve signals and chemical reactions involving the contraction of muscle tissue.

EXAMPLE: When your arm dangles by your side, the bicept muscle is thin and long



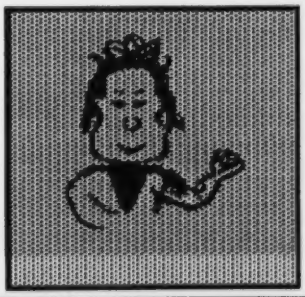
Return

Screen 111

Purpose cont...

Movement of muscles involves a process of nerve signals and chemical reactions involving the contraction of muscle tissue.

EXAMPLE: When your arm dangles by your side, the bicept muscle is thin and long



But when you clench your fist, and flex your arm, the biceps muscle becomes tense and begins to bulge out.

Return

Screen 112

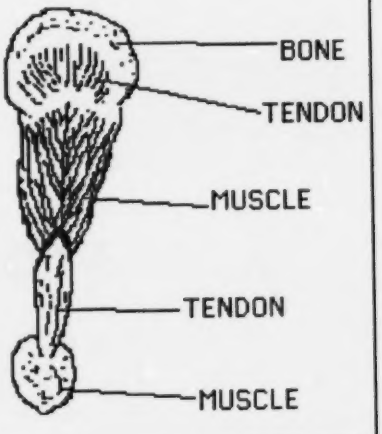
purpose cont...

Muscles are sometimes called the "body's movers".

For every bone in your body that can move there are muscles to move them.

Muscle are firmly attached to bone by *tendons*.

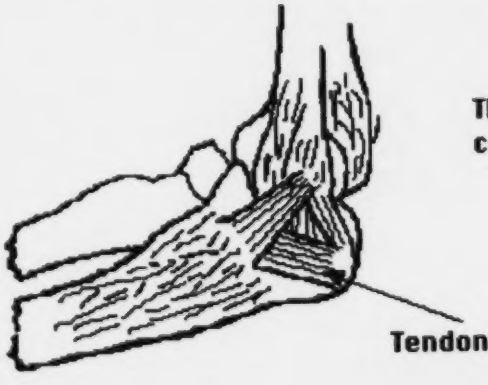
Tendons are tough connective tissue that do not stretch very much.



Return

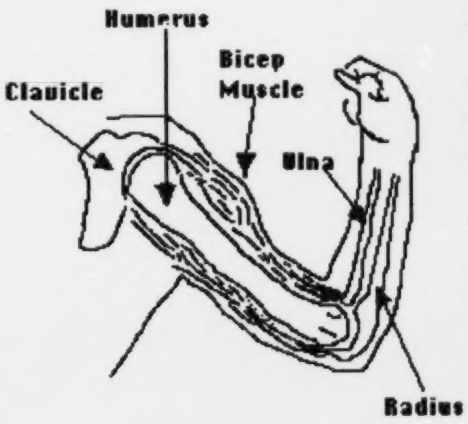
Screen 114

A tendon connects muscle to bone and helps to pull the bone when it moves



The picture illustrates the tendon connecting muscle to bone

Return



What you see now is a bend arm.

One set of muscle pull, meaning it contracts making the muscle short, pulling the forearm up

To straighten the arm one set of muscles are relaxed while another pulls in the opposite direction, straightening it.

Return

Screen 115

A muscle move the bone by pulling it, that is when it contracts and becomes shorter.

The arm you see is stretched out, the muscles are relaxed.

Screen 116

TYPES OF MUSCLE TISSUE

The three types of muscle tissue are :

1. **CARDIAC MUSCLE**

   The heart is made up of a tissue called the cardiac muscle tissue. The heart is the only place within the human body this muscle tissue is found, *" right where the heart is ".*

Heart Muscle

Return

Screen 117

Muscle Tissue cont...

2. **STRIATED MUSCLE TISSUE**

   The striated muscle tissue is also called *voluntary muscle* because it is controlled by the *voluntary nervous system.*

   This means you have control over this muscle such as moving your arm, talking, walking and other movements.

Striated Muscle Cell

Return

Screen 118

Muscle Tissue cont...

Striated muscle tissue looks striped when observed under a microscope.

These muscles are attached to bone, other muscles and skin.

Sometimes they are also refered to as *skeletal muscles.*

Striated Muscle Cell

Return

Screen 119

Muscle Tissue cont...

3. NON-STRIATED MUSCLES

Also called involunary muscles because they are controlled by the sympathetic nervous system.

The involuntary (sympathetic) nervous system controls body functions such as : digestion, breathing etc.

Smooth Muscle Cell

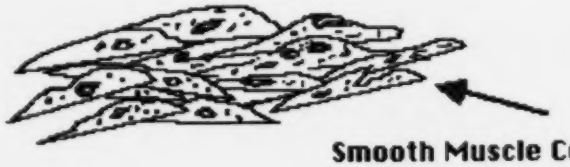
Return

Screen 120

Muscle Tissue cont...

Involuntary muscle tissue appears smooth when observed under a microscope.

The cells of this tissue are long and slender in shape and are found in the walls of intestines and blood vessels.



Smooth Muscle Cell

Return

Screen 122

ORIGIN AND INSERTION OF MUSCLE

A muscle contracts and shortens, therefore it has to be attached firmly fixed on one end while it remains movable on the other end.

Return

Screen 123

continued...

The movable end of the muscle is the INSERTION and is often attached to skin and to movable bone.

Remember when you laugh your facial skin moves,

ORIGIN The part which is fixed to other muscle or to bone.

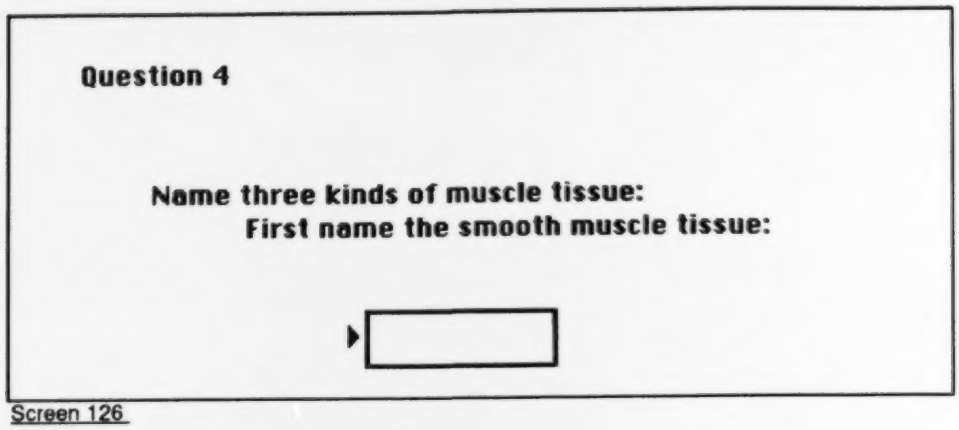
When muscle is stimulated it contracts by becoming shorter and thicker and both ends of the muscle come closer together.

Return

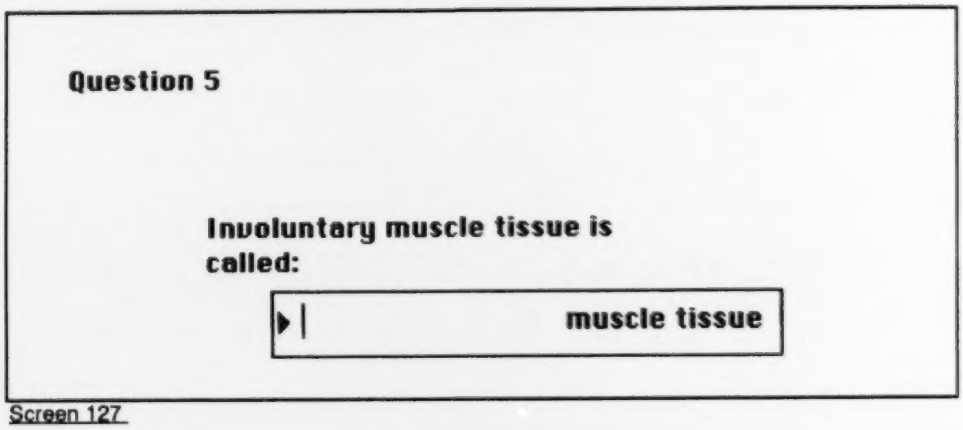
Screen 125

Question 3

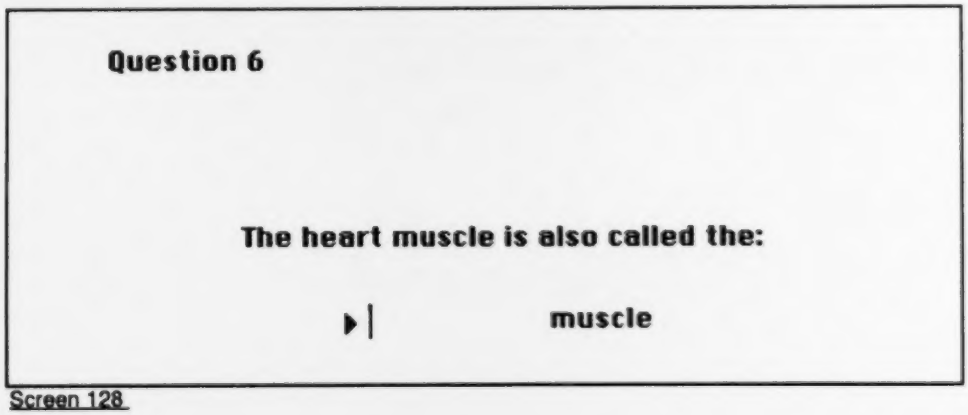
Give the technical name for the scientific study of muscles, their function and structure:



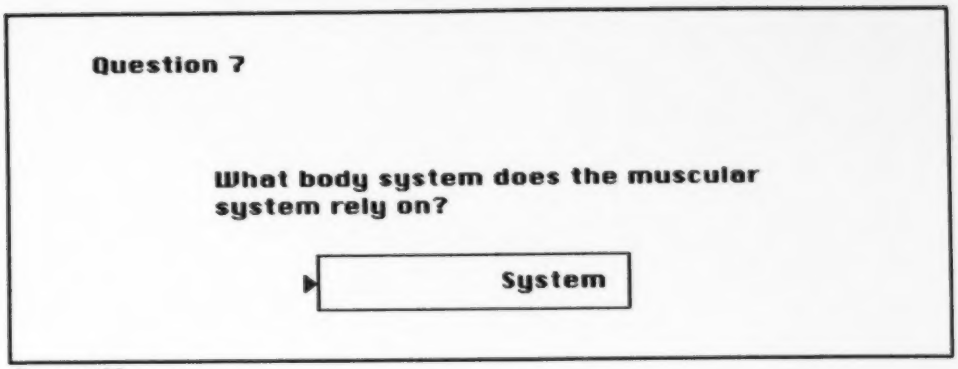
Screen 126



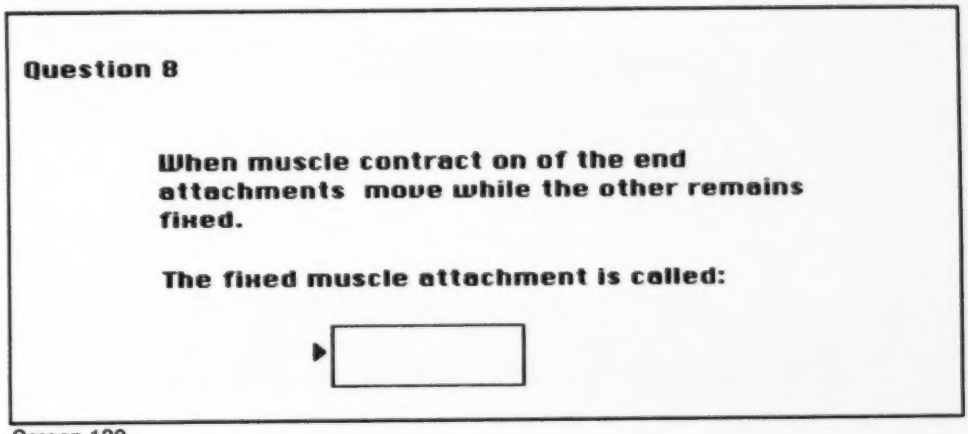
Screen 127



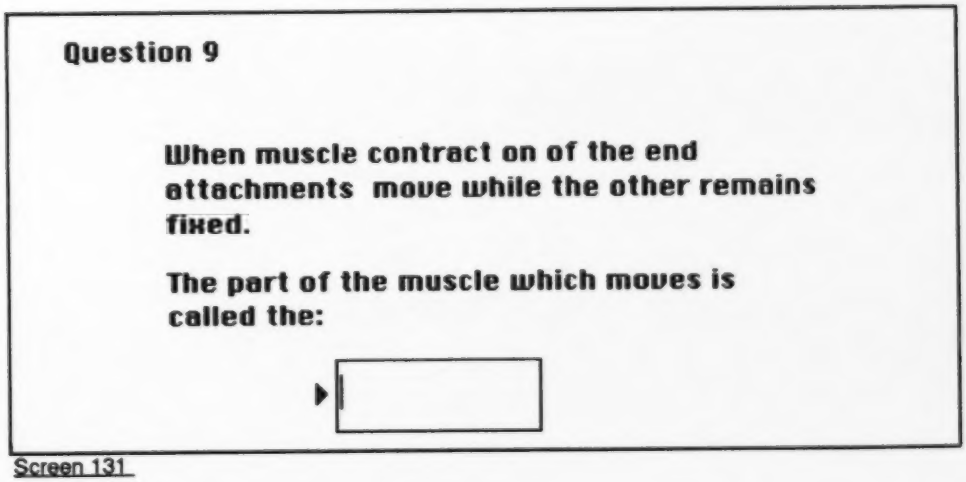
Screen 128



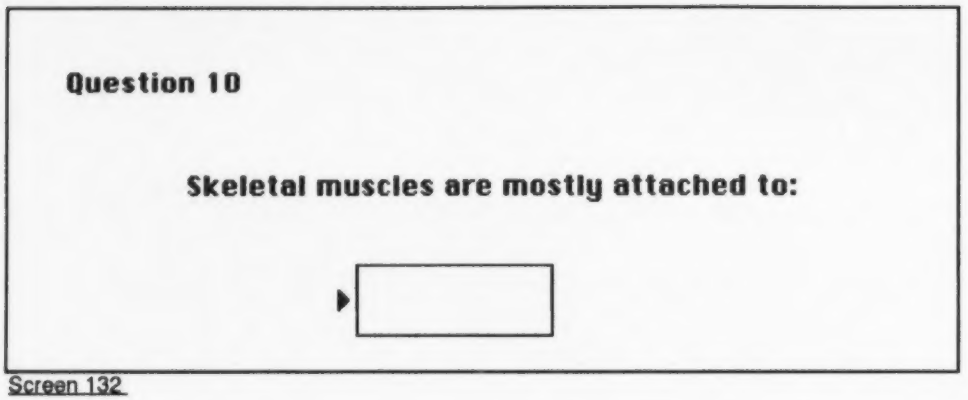
Screen 129


Question 8
When muscle contract on of the end attachments move while the other remains fixed.
The fixed muscle attachment is called:

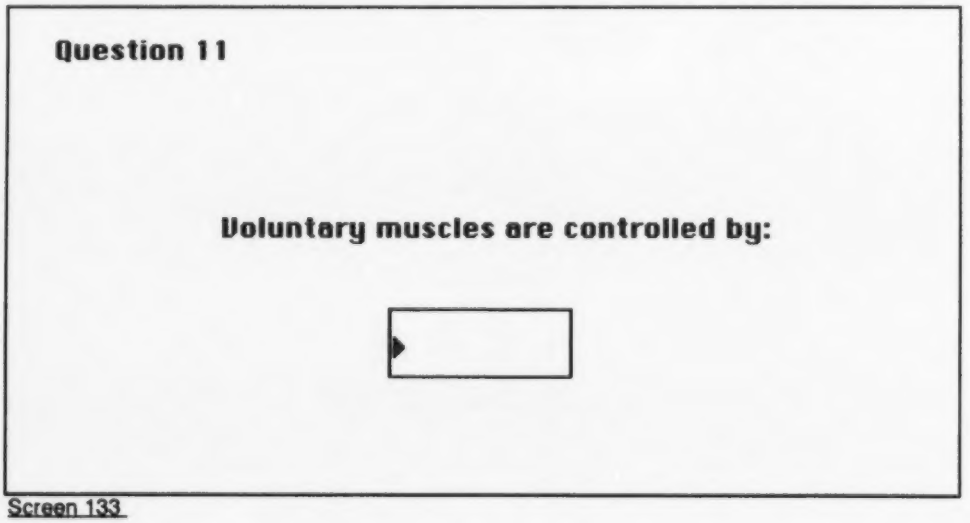
Screen 130


Question 9
When muscle contract on of the end attachments move while the other remains fixed.
The part of the muscle which moves is called the:

Screen 131



Screen 132



Screen 133

ORBICULARIS OCULI

These are bands of circular muscle fibre in the eye socket.

These muscles help open and close the eyelid.

When massaging this area great care is necessary so as not to damage the sensitive tissue of the eye.

Return

Screen 134

LEVATOR LABII

The levator labii superioris reaches from the maxilla to the upper lip.

It's function is to raise the upper lip

Return

Screen 135

NASALIS Muscles of the nose

Located on top of the nose.

Very useful when wrinkling the nose

Return

Screen 137

ZYGOMATICUS

The zygomatic muscle reaches from the zygomatic bone to the corner of the obicularis muscle.

It is used when drawing the angle of the mouth back and up when smiling

Return

Screen 136

BUCCINATOR

The buccinator is a long muscle, it reaches from the mandible and maxilla to the orbicularis oris muscle all the way to the skin of the lips.

It serves to draw in the cheeks, useful when whistling or blowing.

Return

Screen 138

ORBICULARIS ORIS

The orbicularis oris muscles surround the lip and perform functions such as puckering the lip, also useful when kissing.

This area of the face is often massaged to keep it flexible and toned.

Return

Screen 139

MASSETER

The masseter muscle is located from the front of the ear to the angle of the jaw.

It is used when clenching the teeth.

When giving a facial it isa important to relax this muscle.

Return

Screen 140

RISORIUS

The risorius muscle is part of the subcutaneous tissue at the corner of the mouth.

It is used when smiling.

So I hope you smile a lot!!!

Return

Screen 141

DEPRESSOR ANGULI

This muscle reaches from the mandible to the lower corners of the mouth.

This muscle is used to draw down the corner of the mouth

Return

Screen 142

QUESTION 12

Please observe the term very carefully and the select the term which best fits the description and drag it to it's location.

	TERMS TO BE MOVED
EPICRANIUS	CHIN
ORBICULARIS ORIS	EYE
CORRUGATOR	SCALP
ORBICULARIS OCULI	MOUTH
MENTALIS	EYEBROW

EXIT

Screen 143

EPICRANIUS MUSCLE

The epicranius muscle, a very large muscle joined by a flat sheet of connective tissue, known as the aponeurosis.

The two parts of the epicranius are the:

OCCIPITALIS
&
FRONTALIS

Return

Screen 144

MUSCLE OF THE FRONTALIS

This muscle runs along the eyebrows all the way to the ***Aponeurosis.***

The action of this muscle helps raising the eyebrows and wrinkles the forhead when frowning.

Massaging the tissue in this area is often helpful in relieving tension and headaches.

Return

Screen 145

OCCIPITALIS

The back portion of the epicranius, the occipitalis is situated from the occipitalis bone to the aponeurosis.

It's function is to draw the scalp backward.

Why don't you try to move your own scalp backward, see if it works?

Return

Screen 146

TEMPORALIS

The temporalis muscle is located on the side of the head above the ear.

This muscle gets a lot of use when you bite down on something.

When massaging this area it tends to relieve headaches and induces relaxation.

Return

Screen 147

QUESTION 13

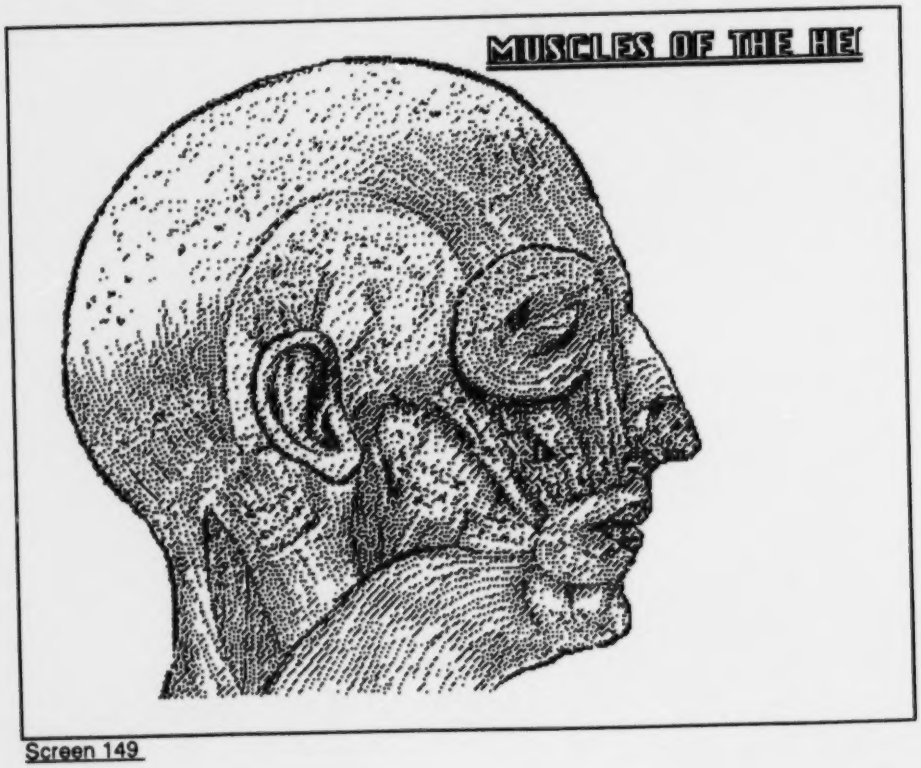
MUSCLES OF THE HEAD DISPLAY

The next objective is to point the mouse on the correct place of graphic display.

Double click the mouse when selecting the spot you chose for your response to the question.

Return

Screen 148



Screen 149

MUSCLES OF THE TRUNK

Muscles of the trunk are:

Latissimo Dorsi:

The broad muscle of the back.

It's function is to draw the arm to the body and rotating it outward.

Return

Screen 150

Trunk Muscles cont...

STERNOCLEIDOMASTOIDEUS

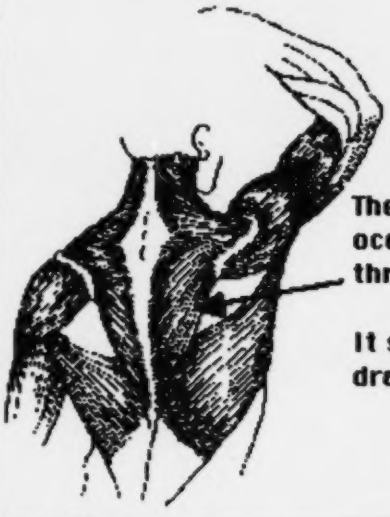
This muscle reaches all the way from the clavicle and sternum to the bony part behind the ear.

It flexes the head toward the shoulder and turns the face in the opposite direction.

Return

Screen 151

Trunk Muscles cont...



TRAPEZIUS

The trapezius muscles cover the area from the occipital bone, the vertabrate of the neck and throat to the clavicle and scapula.

It serves to rotate the shoulder blades and draws the head back to one side.

Return

Screen 152

Biceps Brachii

The biceps brachii reaches from the scapula to the radius bone in the forearm.

It's function is to flex the forearm.

Return

Screen 153

ARM MUSCLES

Deltoid Muscle

The deltoid muscle covers the clavicle and scapula down to the humerus bone.

It extends and rotates the arm

Return

Screen 154

SUMMARY

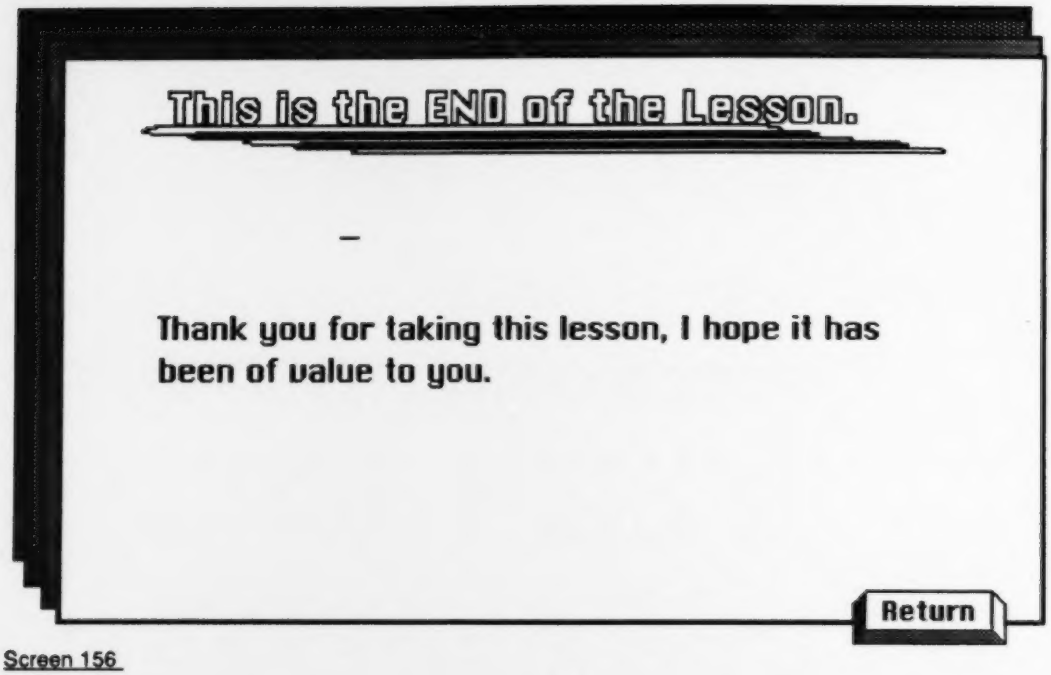
Muscular system covers, supports and provides shape to the human body.

Body has over 500 muscles making up 40 to 50% of the body weight.

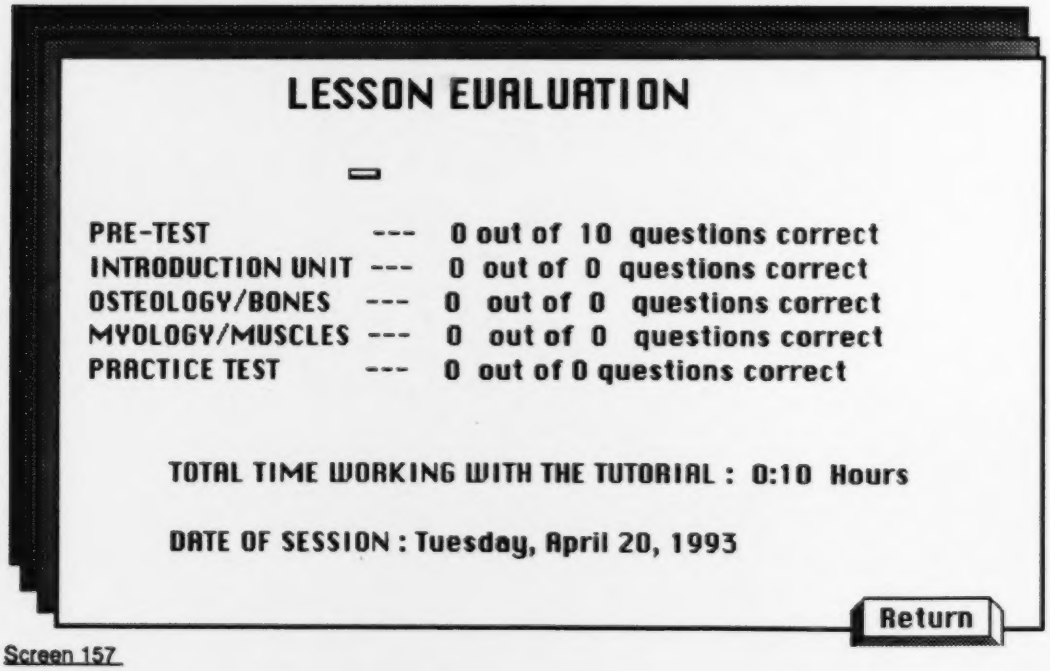
Muscle tissue:

1. Cardiac Muscle - heart muscle
2. Striated Muscle - controlled by the voluntary nervous system
3. Non-Striated Muscle - controlled by the involuntary nervous system

Screen 155



Screen 156


LESSON EVALUATION
PRE-TEST --- 0 out of 10 questions correct
INTRODUCTION UNIT --- 0 out of 0 questions correct
OSTEOLOGY/BONES --- 0 out of 0 questions correct
MYOLOGY/MUSCLES --- 0 out of 0 questions correct
PRACTICE TEST --- 0 out of 0 questions correct
TOTAL TIME WORKING WITH THE TUTORIAL : 0:10 Hours
DATE OF SESSION : Tuesday, April 20, 1993
Return

Screen 157

Appendix G

CAI Glossary

GLOSSARY SELECTION

YOU MAY SELECT A GLOSSARY TERM BY EITHER:

Pressing the Command ( ) key and the number of your choice.
OR Clicking the mouse on the letter range you want.

TERM FROM :

1. A to G
2. H to N
3. O to Z

Glossary 1

GLOSSARY

ABDUCTOR	A muscle that allows the finger to spread apart.
ADDUCTOR	Muscle which draws the fingers together.
ADRENAL	Gland positioned above the kidney producing the
ANATOMY	Study of the human body, its organs and systems.

Return

GLOSSARY

BICEPS Having two heads; a muscle producing the contour of the front and inner side of the upper arm.

BIOLOGY The science of life and living things.

BLOOD Fluid circulating in blood vessels throughout the body.

BLOOD VASCULAR SYSTEM Comprised of structures (the heart, arteries, veins and capilaries) which distribute blood throughout the body.

BLOOD VESSEL An artery, vein or capillary.

Return

GLOSSARY

BRACHIAL ARTERY Main blood vessel in the upper arm.

BRAIN Part of the central nervous system contained within the skull.

BUCCAL NERVE A motor nerve affecting the buccinator and the orbicularis oris muscle.

BUCCINATOR A thin, flat muscle of the cheek, shaped like a trumpet.

Return

Glossary 4

GLOSSARY

CANCELLOUS	A structure which is porous and spongy like.
CANINUS	The muscle which lifts the angle of the mouth.
CAPILLARY	Very small blood vessels connecting veins to arteries.
CAPITATE	The large bone of the wrist.
CAPUT	Pertaining to the head.
CARDIAC	That which is related to the heart.
CAROTID	Large artery carrying blood to the head.

Glossary 6

GLOSSARY

CARPUS	The wrist; the eight bones of the wrist.
CARTILAGE	Gristle; a non-vascular connective tissue softer than the brain.
CEREBELLUM	Back and lower part of the brain.
CEREBRAL	Pertaining to the cerebrum.
CEREBRO-SPINAL SYSTEM	Consists of the brain, spinal cord, spinal nerves and the cranial nerves.
CEREBRUM	The superior and larger part of the brain.

Return

Glossary 5

GLOSSARY

CIRCULATION	The passage of blood throughout the body.
CLAVICLE	Collarbone, joining the sternum and scapula.
CORPUSCLES Red	Cells in blood, whose function is to carry oxygen to the cells.
CORPUSCLES White	Cells in the blood whose function is to destroy disease germs.
Cranium	The bones of the head excluding bones of the face; bony case for the brain.

Return

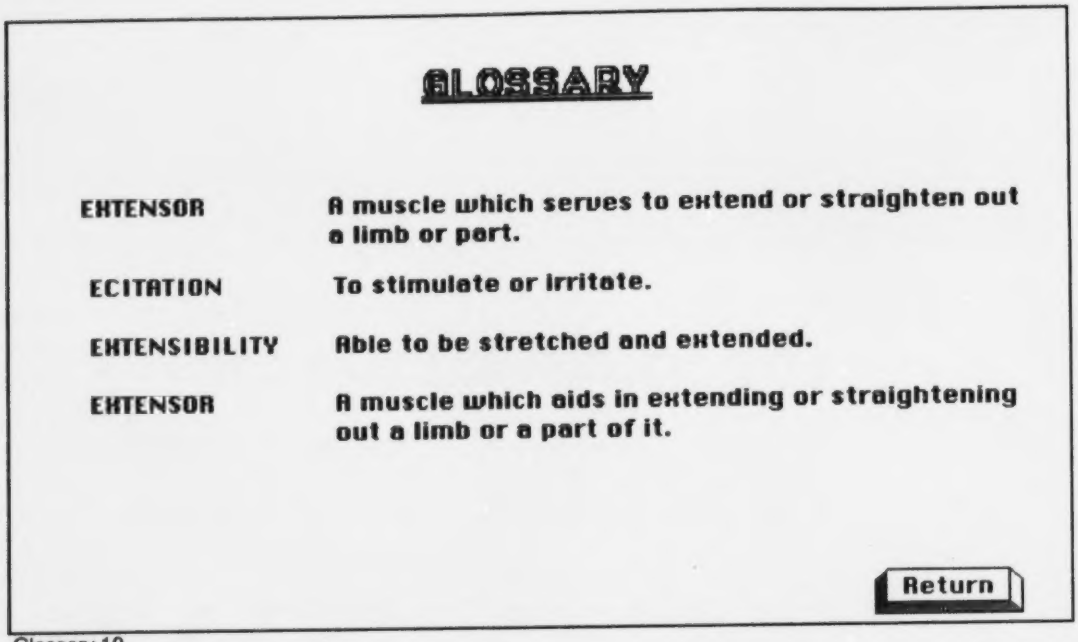
Glossary 7

GLOSSARY

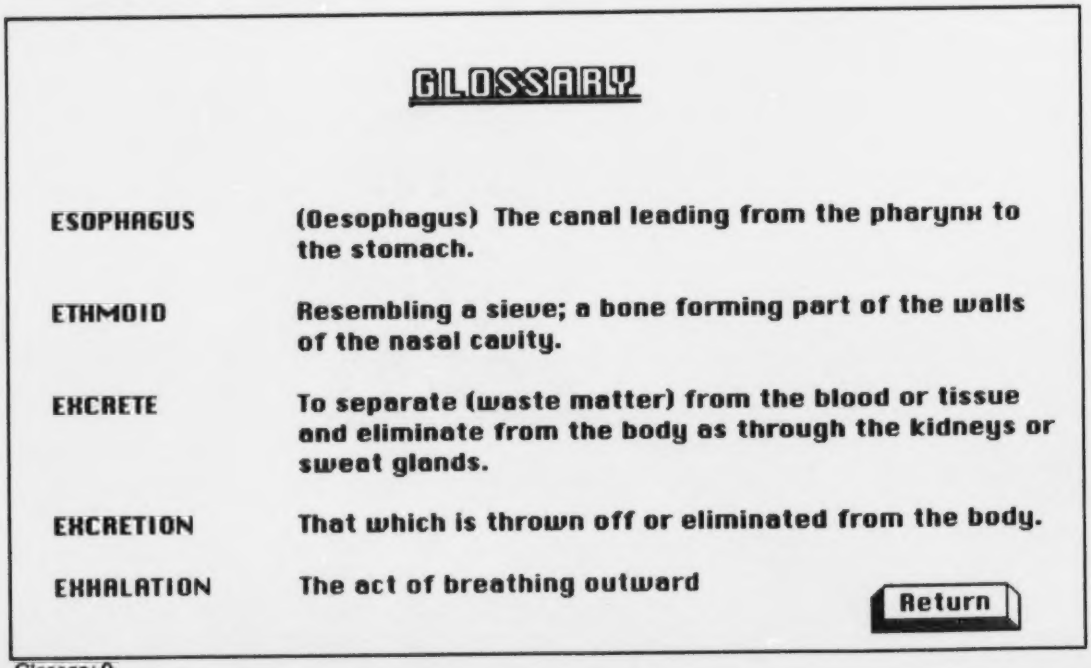
DELTOID	Shoulder muscle
DEPRESSOR	That which presses or draws down; a muscle that depresses.
DIGITS	Fingers or toes
DILATOR	That which expands or enlarges.
DUCT	A passage or canal for fluids.

Return

Glossary 8


GLOSSARY
EXTENSOR
A muscle which serves to extend or straighten out a limb or part.
ECITATION
To stimulate or irritate.
EXTENSIBILITY
Able to be stretched and extended.
EXTENSOR
A muscle which aids in extending or straightening out a limb or a part of it.
Return

Glossary 10


GLOSSARY
ESOPHAGUS
(Oesophagus) The canal leading from the pharynx to the stomach.
ETHMOID
Resembling a sieve; a bone forming part of the walls of the nasal cavity.
EXCRETE
To separate (waste matter) from the blood or tissue and eliminate from the body as through the kidneys or sweat glands.
EXCRETION
That which is thrown off or eliminated from the body.
EXHALATION
The act of breathing outward
Return

Glossary 9

GLOSSARY

FACIAL	Pertaining to the fact; the seventh cranial nerve.
FASCIA	A sheet of connective tissue covering supporting, or binding together internal parts of the body.
FLAGELLA	Slender whip-like processes which permit locomotion in certain bacteria.
FLEXOR	A muscle that bends or flexes a part or a joint.
FREQUENCY	The number of complete cycles per second of current produced by an alternating current generator. Standard frequencies are 25 and 60 cycles per second.

Return

Glossary 12

GLOSSARY

FRICTION	The resistance encountered in rubbing one body on another.
FRONTAL	In front; relating to the forehead; the bone of the forehead.
FRONTALIS	Anterior portion of the muscle of the scalp.

Return

Glossary 11

GLOSSARY

GENE	The ultimate unit in the transmission of hereditary characteristics.
GENETIC	The genesis or origin of something.
GLAND	A secretory organ of the body.
GLOSSOPHARYNGEAL	Pertaining to the tongue and pharnyx; the ninth cranial nerve.
GREAT AURICULAR	A nerve affecting the face, ear, neck and parotid gland.

Return

Glossary 13

GLOSSARY

HAIR	A slender outgrowth from the skin.
HAVERSIAN CANALS	Small channels through which the blood vessels devide in bone tissue.
HUMERUS	A large bone located in the upper arm.
HYOID	A u-shaped bone located above the larynx (adam's apple).

Return

GLOSSARY

INDEX FINGER The pointing finger; forefinger.

INFERIORIS Below; lower.

INVOLUNTARY MUSCLE Muscle funcioning without will; automatic muscle action.

IRRITABILITY Easily stimulated; excitable.

Return

Glossary 15

GLOSSARY

JOINT A connection between two or more bones.

JOWL Loose skin, part of the chin hanging down,

JUGULAR Area around the neck and throat; large vein at the side of the neck.

Return

Glossary 16

GLOSSARY

KERATIN	A protein substance which makes up hair, nails and skin.
KERATOID	Hornlike; hardened horny tissue.
KINESICS	Stydy of body movement.
KNEE	Joint of the human leg.
KNUCKLE	Joint connecting fingers to the hand.

Return

Glossary 17

GLOSSARY

LABIA	Pertaining to the lips.
LACRIMAL BONE	Small thin bone located in the anterior medial walls of the eye sockets
LEVATOR ANGULI ORIS	Muscle of the upper lip.
LEVATOR LABII SUPERIORIS	Muscle from the maxilla to the upper lip.
LARYNX	The upper part of the wind pipe, produces the voice

Return

GLOSSARY

MAXILLA	Bone of the upper jaw.
MAXILLARY	Pertaining to the upper jaw.
MEDIAL	Pertaining to the middle
MEDIAN	Pertaining to the middle.
MENTALIS	Muscle of the lower lip.
METACARPAL	Pertaining to the bones of the palm of the hand.

Return

Glossary 19

GLOSSARY

METACARPUS	The bones of the palm of the hand.
MUSCLE	A contractile tissue of the body aiding in producing movement.
MUSCLE TONE	Normal degree of tension in a healthy muscle.
MYOLOGY	The science of the structure, function and disease of muscles.

Return

Glossary 20

GLOSSARY

NARIS	Nostril
NASALIS	Muscle of the nose.
NON-STRIATED	Involuntary muscle.

Return

Glossary 21

GLOSSARY

OCCIPITAL	Bone which forms the back and lower part of the cranium.
OCCIPITO-FRONTALIS	Scalp muscle of the epicranium.
OPHTALMIC	Pertaining to the eye.
ORBICULARIS OCULI	The ring muscle of the eye
ORBICULARIS ORIS	Muscles surrounding the mouth.

Return

Glossary 22

GLOSSARY

ORBIT	Bone cavity of the eye, eye socket.
ORIGIN	The beginning of; attachment of a muscle to bone.
ORIS	Pertaining to the mouth; opening.
OS	Bone

Return

Glossary 23

GLOSSARY

Phalanges	Long bone of the figer or toe.
PHARYNX	Upper part of the digestive tube, behind nose and mouth.
PHYSIOLOGY	Science of the functions of living things.
PLATYSMA	Thin, broad muscle of the neck.
POSTERIOR	Situated behing; coming after.

Return

Glossary 24

GLOSSARY

QUADRATIS LABII SUPERIORIS	Muscle of the upper lip.
QUADRATIS LABII INFERIORIS	Muscle of the lower lip.

Return

Glossary 25

GLOSSARY

RADIUS	The outer, smaller bone of the forearm.
REFLEX	An automatic response to a stmulus, an involuntary reaction.
RISORIUS	Muscle at the side of the mouth.
ROTATE	To revolve, turning.

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GLOSSARY

SCALP Skin which covers the cranium.

SCAPULA Large bone, somewhat triangular in shape, shoulder blades.

SHOULDER The body parts connecting the arm to the trunk.

SKELETAL MUSCLES Muscle connected to bone.

SKELETON Boney framework of the human body.

SKULL Bones of the head.

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GLOSSARY

SPHENOID Wedge shaped bone at the base of the skull joining all bones of the cranium.

STERNOCLEIDOMASTOIDEUS Head muscle which allows movement of the head.

STERNUM Breast bone.

SUPERIOR Upper, better, more important.

SUPERIOR AURICULARIS Muscle of the ear which draws the ear up.

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GLOSSARY

TACTILE	Pertaining to feeling, sensing, touching.
TEMPLE	Sides of the forhead.
TEMPORAL	Pertaininmg to the sides of the forehead.
TEMPORAL BONE	Bone at the side of the skull.
TEMPORALIS	Muscle of the temporal region.
TENDON	Fibrous tissue connecting muscle to bone.

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GLOSSARY

THORAX	Body part between the neck and the abdomen, chest.
TRAPEZIUS	Muscle which draws the head back and sideways.
TRIANGULARIS	Muscle which pulls down the corners of the mouth.
TRICEPS	Large muscle of the arm allowing extension of the forarm.

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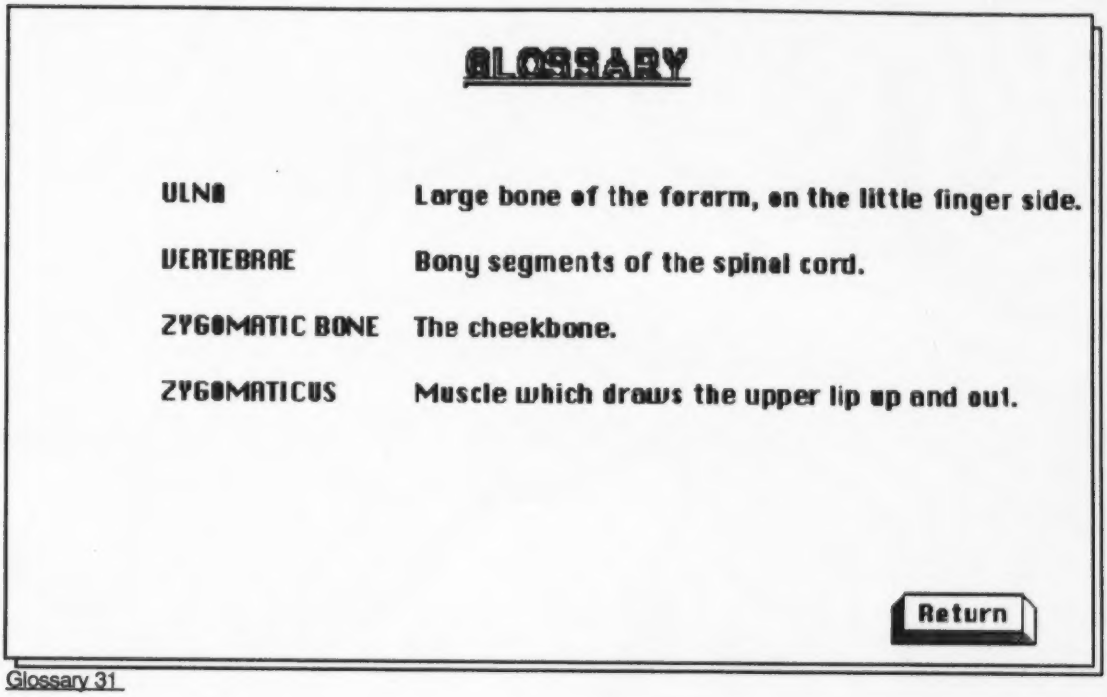
GLOSSARY
ULNA
Large bone of the forarm, on the little finger side.
VERTEBRAE
Bony segments of the spinal cord.
ZYGOMATIC BONE
The cheekbone.
ZYGOMATICUS
Muscle which draws the upper lip up and out.
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